ELECTRICAL REVIEW

[ILLUSTRATED.]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

Vol. 10. No. 14. WEEKLY. | NEW YORK, SATURDAY, JUNE 4, 1887. | $3 per annum. Single Copies, 6 Cents.

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Electric Lighting for Steam Yachts.

The accompanying illustrations will give an excellent idea of a combined engine and dynamo recently constructed by the Sawyer-Man Electric Company, 32 Nassau street, this city, for the yacht "Restless," owned by W. M. Singerly, Esq., proprietor of the Philadelphia *Record*, and which is particularly adapted for use in the incandescent electric lighting of steam yachts. Its advantages are that it occupies very little space, and is economical in the amount of steam required.

These dynamos are made by the Sawyer-Man Electric Company, under patents of C. R. Arnold, in sizes adapted to run either 30 or 50 lights, and can be furnished in larger sizes, if desired. The one on the "Restless" is rated as a 30-light machine, and is actually running 34 lamps, and giving the greatest satisfaction.

Mr. Frederick Lovejoy, president of the Ball Electric Light Company, after seeing the plant in operation upon the "Restless," has ordered a 50-light machine for his new yacht, now building at the yard of Messrs. Houston & Woodbridge, Linwood, Pa.

The Sawyer-Man Electric Company are in receipt of numerous inquiries concerning this class of work, and will cheerfully furnish further information in regard to these machines to any owners of steam yachts or other interested parties.

The speed of the engine in the combination plant we illustrate is 560 revolutions per minute; dynamo armature, 1,400 revolutions; space occupied—width, 29 inches; length, 30 inches; height, 40 inches. The total weight of engine, dynamo, base, etc., is 600 pounds.

Experiments With High-Tension Electricity.

It is well known that by means of a suitable commutator, driven by clockwork or otherwise, and connected with a condenser, the plates of which are alternately charged in parallel and discharged in series, a very high tension may be attained with only a single battery cell as the original source of electricity. The apparatus is, however, more expensive, and even more likely to suffer damage than the modern forms of static induction machines, so that it is very seldom employed in this country. In France, however, the rheostatic machine has always received more favor, and an account of a series of experiments, some of which at least are new to us, carried out with one of these machines, appeared recently in our contemporary, *Electricité*. One advantage of the rheostatic machine is that the E.M.F. between the discharging points can be closely calculated if we simply know the E.M.F. of the source, the capacity of each pair of plates, and the number of pairs of plates in the condenser. However, no estimate as to the E.M.F. required for the following experiments is found in the paper. Let a small glass beaker be filled with salt water, and into this dip a platinum wire connected with one electrode. Take a capillary tube open at both ends, pass a platinum wire through it connected with the second electrode, and dip the tube and wire under the surface of the liquid. In all these experiments, if a static induction machine be employed, the circuit must be continually made and broken elsewhere, either in shunt or series; then, on setting up the interrupted difference of potential, a brilliant spark is seen at the lower extremity of the tube, and the liquid rises a little at each discharge, attaining a height of 0.25m. to 0.30m. The action is just like that of an hydraulic ram. If the height of the tube be less than that to which the liquid could attain naturally it overflows at top, but in doing so the drops pass out of the circuit, and therefore again break forth into flashes and gleams of fire. In the dark the experiment is a very effective one. Next let the beaker be exchanged for an open dish, and take a very short piece of tubing, say about an inch in length. Then on arranging everything else as before, taking care, however, that the tube dips about half its length under water and that the platinum wire passes very nearly right through it, on starting the discharge a fine jet of water is thrown up to the height of about a meter. The noise made by the sparks in this experiment is extremely loud, and the concussions are so violent that the glass vessel is sometimes broken. The experiment is more successful if the wire which enters the liquid without passing through the tube be insulated, except at its extremity. If this be not done a good deal of water is scattered about. This wire should also be the positive pole. If it is made negative the jet is scarcely half as high. A brilliant flaming discharge, giving deafening explosions, may be obtained by allowing the platinum wire to enter at the lower end of a rather short capillary tube (still under water) and to pass nearly to the top; then let the other electrode be brought over the top of the tube. It seems probable that this flame is in part due to the separation and recombination of the elements of water.

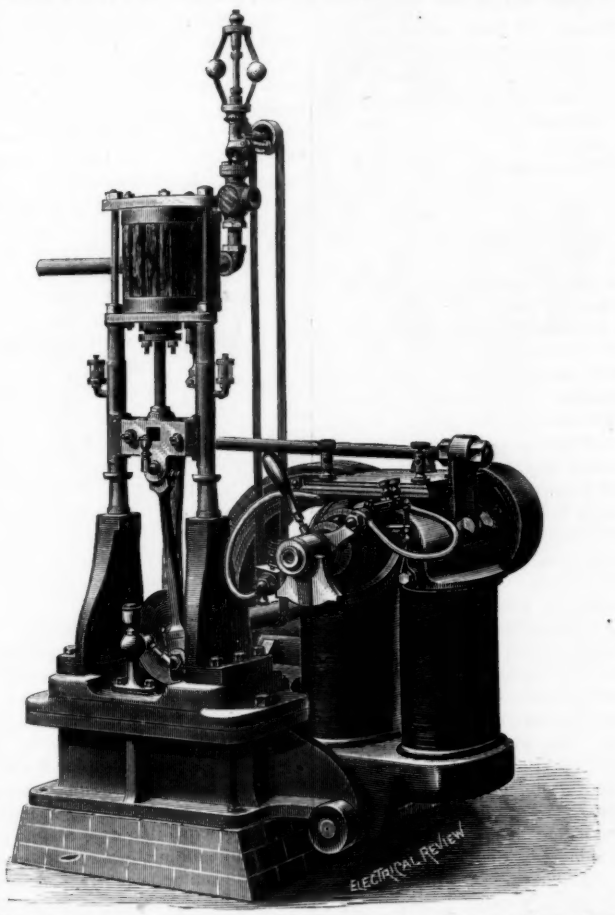

FIG. 1.—FRONT VIEW OF COMBINATION PLANT, BUILT BY SAWYER-MAN ELECTRIC CO. IN USE ON THE YACHT "RESTLESS."

A Club House for the Electric Club.

There was a well attended meeting of the new club house committee of the Electric Club last Thursday evening, May 26. President Davis occupied the chair and an informal discussion was generally participated in by those present, among whom were J. B. Powell, D. L. Hungerford, J. N. Keller, James English, Chas. A. Cheever, W. D. Sargent, Geo. B. Coggeshall, Geo. L. Beetle, Henry A. Reed, Stephen Holbrooke, and H. C. Davis. Several new features relating to the desirability and success of the plan were presented by the president and favorably received. In view of the rapid growth of the club and the probability that any club house that might be purchased now would not answer for the needs of the organization three years hence, it was finally decided to lease a suitable building and a committee was appointed to report Wednesday evening, June 1. The committee is composed of the following gentlemen: J. B. Powell, Eugene T. Lynch, jr., H. S. Reed, Geo. Worthington, H. C. Davis, H. P. Hungerford, M. W. Goodyear.

The United States Supreme Court adjourned until October, last week, without giving a decision in the telephone cases.

Ordinary lead pencils are useful for low resistances from 30 to 200 ohms. The harder grades contain more clay than the softer, and are of higher resistance.

Prof. Elihu Thomson on "Regulating Series Wound Transformers."

To the Editor of Electrical Review:

I notice in your issue of May 21, an article "On Regulating Series Wound Transformers," taken from the London *Electrician*.

As the matter of this article is of something which in several forms has appeared in United States patents issued to me, I send herewith a copy of a letter written to the London *Electrician*.

Very truly yours,
ELIHU THOMSON.

LYNN, MASS., May 24, 1887.

To the Editor of Electrician:

In your issue of April 9, 1887, in an article on regulating series-wound transformers, you describe the interesting work of Messrs. Sharp and Kent, of Westminster, their plan of operations being the substitution of what you term "induction rings" for lamps in the secondary line of induction coil lines in series. A point is also made that the energy expended in a coil which replaces a lamp is in reality quite trifling in amount, etc.

I inclose with this letter copies of three United States patents, which were filed March 19, 1883, May 21, 1884, and May 23, 1884, respectively. An inspection of these patents will show conclusively that they fully disclose the method of regulation in an alternating current system of any kind, consisting in the substitution of self-inductive coils, or what I have termed "reactive coils" for lamps, the coils being constructed to have a very low resistance, and with a large coefficient of self-induction.

In the earliest of the patents, namely, that filed March 19, 1883, there occurs on line 45 the statement: "I use in my system an alternating line current, supplied to the circuit by any suitable generator, or by an induction apparatus whose primary is fed by any suitable generator;" and in line 57 thereafter the statement occurs: "In connection with the lamps or other working resistances of the system I provide a suitable electric reaction device, such for instance, as an electro-magnet and reactive coil, consisting of a bundle of iron wire, or other suitably divided or otherwise constructed core, surrounded by a coil of insulated wire, and whose purpose is, when a lamp, motor, or other device is removed from the circuit, to convey only that current that would have kept the lamp burning. The resistance of the reactive coil is made very small, by preference, and it acts not as a substituted resistance, but as a real counter electro-motive force generator." And further, in line 81, the description continues: "This device operates after the well-known manner of an electro-magnet in an electric circuit to set up what is known as an 'extra' or 'counter' current, whose tendency is to oppose a current sent into the coils at the moment it begins to flow." One of the concluding clauses of the specification I may be permitted to quote, as it bears on the question of the loss of energy. It is: "In the system as herein described any lamp or lamps may be extinguished by simply replacing it by its reactive coil or condenser, or similar device, without the loss of energy of cur

rent, such as occurs when the lamp has a resistance substituted therefor."

The claims, though all relating to this feature of a substituted reactive coil, may be typified by quoting only one, namely, the first: "The combination with an electric lamp or other translating device with a source of rapidly-alternating or reversed currents, of an electro-magnetic, self-inductive reaction device or its described equivalent, normally out of action, and having a definite or determinate counter electromotive force capacity, adapted or adjusted, as described, to permit it, when substituted for a lamp or other device, to oppose or check the passage of the alternating or reversed currents to a degree corresponding to the opposing effects arising from the electric resistance in the translating device."

In my patent filed May 21st, 1884, which is for a system of distribution using a continuous line current commuted through primary coils in series for the generation of secondary currents feeding local lines of lamps which are in multipolar arc or parallel—I refer to Fig. 8, which is described in the specification as follows:

"Fig. 8 is a diagram illustrating a means whereby lights may be cut out in such a manner as not to affect each other's brilliancy." Then further in the description of the said figure occurs the paragraph: "Ordinarily the removal of a light or lights, or other apparatus connected with a secondary, would demand the readjustment of the speed of the commutator or of the relations of the coils or core, in order to avoid any undue flow of current to the remaining lamps. To obviate this, a small reactive coil of low resistance, wound upon an iron core, indicated at *R*, Fig. 8, may be employed and combined with a suitable electric switch, whereby, upon the cutting out of a lamp, said coil may be made to take its place. I mean by 'reactive coil' a coil whose opposition to the passage of alternating currents through it is due simply to its counter electromotive force tendency, and not to its resistance. The coils *R R* of Fig. 8 are of this nature, and since the secondary currents are alternating in character the substitution of one for a light extinguished leaves the relation of the electromotive forces to the remaining lamps constant, so that they do not change their brilliancy."

Claim 4 of this patent bears directly upon this subject matter. It is, "In combination with an induction coil, a local line connected with its secondary, and containing translating devices and reactive coils, having switches, whereby reactive coils may be substituted for lamps extinguished."

The remaining patent, namely, that filed May 25th, 1884, I send merely as illustrating another use of the reactive coil on alternating current circuits.

The applicability of the reactive coil according to the method described in these patents, and its efficiency as a lamp substitute with the saving of energy on such circuits, was proven by practice with this arrangement in a variety of ways. The identity of the device which I have termed "reactive coil" to the "induction ring," as used by Messrs. Sharp and Kent in its functions as a lamp substitute, needs no further proof than a mere inspection of the copies of the patents sent. In fact, I may here make the broad statement that I believe it to be true that with any arrangement of alternating current circuits involving a connection of incandescent lamps in series, or in parallel, or in series multiple, or in multiple series, or whether induction coils are used in series, or in parallel, or in multiple series, or in series multiple, the reactive coil substitute may be used wherever a lamp or lamps are extinguished, and a proper balance of the distribution of the current effected thereby, so that the remaining lamps are undisturbed in brilliancy, and that a corresponding saving of energy, within a few per cent., will take place in proportion to the number of lamps extinguished in the system.

Yours truly,

(Signed) ELIHU THOMSON.

Lynn, Mass., May 16, 1887.

The Patent System of the United States.

To the Editor of Electrical Review:

It is well known to all inventors, manufacturers, and owners of patent rights that in all other countries except the United States there is substantially no impediment or obstruction to the inventor's obtaining his patent on paying the required government fees—provided his application for a patent is formally correct. And this was the manner of granting patents in the United States prior to 1836, when, for the first time, the law provided that no patent should be granted unless the Patent Commissioner should first decide that the invention was patentable. The report of the Commissioner of the patent office work during 1837 stated that he had granted under the new law 435 patents—about the same number that are now granted on Tuesday of each week. In speaking of the operation of the new law the Commissioner says:

"Power is given to the Commissioner to refuse a patent if the invention is not deemed sufficiently useful; but this power is seldom exercised, and is confined to cases where the patent may be in some way injurious, the improvement frivolous, or where an attempt is made to avoid a prior patent. It is the intention of the Commissioner to err (if at all) on the side of liberality, leaving the parties to the courts to contest their doubtful rights."

* * * * *

"Under the former law no examination as to the originality of inventions was made, and duplicates and triplicates of the same thing were often patented."

* * * * *

"In all cases of rejection an appeal can be made from the decision of the Commissioner, but no such appeal has yet been taken."

Until within a few years before the passage of the law of 1836—patented inventions were kept secret even from the public—and, of course, as the Commissioner says, duplicates and triplicates were even patented Now the case is far different with patented inventions. As soon as the patent is now granted a complete copy of the drawings and specifications can be obtained for a nominal sum—a few cents. If that had been the case in 1836, when the foundation was laid for the present complex and costly patent office machinery, confessedly there would have been no need of enacting a law authorizing the Patent Commissioner in an ex parte and arbitrary manner to decide whether or not an invention was patentable before he granted a patent for the invention. At various times a little more power has been granted to the patent office to usurp judicial functions—until now, when there is a rich and grasping party to an interference contest in the patent office—thousands upon thousands of dollars are sometimes spent (unless the other side is too poor to fight) just to obtain a patent from the patent office. And this patent is no guaranty whatever—is of no authority—except that it simply and only gives its owner a chance to renew the fight again in the Federal courts. All these enormously costly patent office proceedings go for nothing. The whole ground has to be wholly traversed again precisely as though there had been no unseemly scrimmage in the patent office.

As every patent office attorney knows, sometimes hundreds, and sometimes even thousands of dollars are paid to an attorney to obtain a much coveted patent. What chance has a worthy, a poor, and an honest inventor in such a money-demoralized atmosphere as must necessarily be thus created in the corridors of the patent office?

But the present system of patent office examination is all radically wrong on principle When that is admitted discussion is at an end.

No patent has any established value until after one or more favorable adjudications on its merits by one or more United States Courts has been obtained. Then why tax the inventor with this double contest in the patent office first, and then in a United States Court? If the patent office struggle decided anything whatever, then that ruinous contest might not be so absolutely useless.

The patent office contest is only useful to the rich, the unscrupulous, and the dishonest party whose heavy money bags will slug the poor but worthy inventor every time.

Congress should at once abolish this patent office examination, and return to the earlier practice in this country (as it always has been substantially in all the rest of the world), and give every inventor his patent on his paying the required government fees, provided his patent application is formally correct, and leave all contests to the courts, which is exactly what must be done now in all cases before anything is considered reliable or settled concerning the monopoly granted by the patent.

The patent owner has a hard time enough in the courts without compelling him to run the doubtful and expensive gauntlet of the patent office before he reaches the court ring, all out of wind and money.

In conclusion the reader will see how serious the final fight is—the court fight—if I quote the comparatively recent words of the careful and learned editor of the Albany (N. Y.) *Law Journal*, touching infringing suits:

"We publish this week a remarkable communication about the patent system. We have for many years believed that there is a great deal of humbug in the system itself, and a great deal of oppression and injustice in the administration Our correspondent sets forth a terrible arraignment, and yet we dare say the experience of almost every patent lawyer will confirm him. It is notorious that most poor inventors are cheated out of their rights by the oppression of capitalists, and the tediousness, inequality and expensiveness of the practice in the Patent Courts. We have no doubt, too, that some of the Federal judges carry on things with a high hand when the mood is on them. This comes of making them independent of the people, whose servants they are. It is a wholesome thing to have a judge to know that he is liable to step down and out at a fixed time if he does not behave himself. A judicial tyrant is the worst sort. Is not here another 'living issue' for the consideration of the American Bar Association—The Patent System and the Administration of the Patent Laws?"

JOHN MCCLARY PERKINS.

BOSTON, MASS., May 24, 1887.

The Electric Club Will Lease a Temporary Home.

(From New York *Times*, May 27.)

The General Committee of the Electric Club having in charge the plan of constructing a building in this city which will be the general headquarters of that industry on the Atlantic coast, met at the club-rooms in the Hotel Dam last evening for primary consultation. President Davis, of the club, occupied the chair, and there was a full attendance.

After an informal discussion as to the general plan and its more important details, John B. Powell, general manager of the Brush-Swan Company, took the floor to say that the necessity of an electric clubhouse was generally appreciated. The only question was as to construction or leasing. The club was in good circumstances, and had unlimited financial backing if it desired to build. The question was, Should it proceed at once to building, or await the views of the rapidly incoming members, and lease a temporary building?

The latter suggestion coincided with the views of D. L. Hungerford, of Waterbury, Conn., who took a conservative view. He said that within three years there would be between 750 and 1,000 members of the club. They were all interested in the question, since it was one affecting all representative electricians. He did not think that 250 members should take it upon themselves to make final arrangements. He advised leasing.

Charles A. Cheever, of New York, and James English, of New Haven, were of the same opinion.

Mr. Powell therefore moved that a special building committee of seven be appointed from the General Committee, for the purpose of seeing if a suitable building can be obtained by the club, to be leased for a period not to exceed three years. The motion was unanimously carried, and the chair appointed Messrs. Powell, E. T. Lynch, jr., H. A. Reed, George Worthington, H. C. Davis, D. L. Hungerford and M. W. Goodyear. The committee will report next Wednesday evening.

The Circulation of the Blood—A Theory That Electricity is the Motive Power.

A PAPER BY WILBER L. STONEX, A. M.

While in college I used to assist occasionally in an experiment which afforded us much amusement, and was also a source of constant wonder. It was this: One of our number would lie down on a table, and four others would stand around the body, two on either side, one at the shoulder and one at the thigh; and then, slowly and together, all would draw in their breath with a full inspiration three times. With the third inspiration the four would put their finger tips under the body of the fifth and lift. With marvelous ease the body would be lifted high in the air, but immediately after would fall heavily unless strong muscular efforts were made to prevent it.

A few years since my attention was again drawn to the subject, and I began to study into it. I found that while at the first attempt three full inspirations, and sometimes more, were necessary before the best results were reached, after a few trials no preliminary inspirations were required. I also found that the experiment could only be performed successfully when all the persons lifting drew in their breath and lifted at the same instant. I then found that it was wholly immaterial whether the person who was being lifted drew in his breath or not. I also found that it could be as well performed on a dead weight as on a living body—the weight I used was a heavy iron letter-press. I also found that one person alone could perform the experiment as well as when acting with others.

These experiments proved to me that the power which enabled me to lift the weight came with the act of inspiring, and as the natural result of that act. It then occurred to me that as the air we breathe is the great storehouse of electricity, perhaps the act of inspiration which serves to bring into the lungs this air brings also its electricity with it, and that electricity is thus taken from the air into the human system, and that by thus charging the system with electricity it is enabled, at the instant, to exert the unusual strength shown by the experiment to which I have referred. The thought then suggested itself that this electricity, when brought into the system by the act of inspiration, is not lost by the succeeding expiration, nor expended in any momentary effort made at the time, but is, in part at least, stored in some part of the system. This was suggested by the fact, proven by the experiment to which I have referred, that before the requisite strength could be attained to perform the experiment successfully it was necessary to make several full inspirations; but this having been once attained a single inspiration supplied enough additional power to enable the same result to be accomplished. If this suggestion was correct, there must be, necessarily, somewhere in the human system an organ to perform this function, and if the force is electricity the organ should correspond to a battery of Leyden jars. My first thought was that the cells of the brain performed that function. For the purpose of satisfying myself on this point, I made inquiry of gentlemen on whose knowledge of anatomy I could rely, and the result was to fully convince me of the correctness of my first impression, and also to convince me that this same electric force, acting through the heart, is the force which impels the blood in its circulation through the system.

If this last conclusion is correct, it requires the statement of a new theory, for the existing theories do not recognize the force I have named as the force upon which the circulation of the blood depends. In fact, I think I can safely say that no theory sufficiently accounting for it has yet been advanced. It is conceded, I believe, that mere muscular contraction is insufficient, even to account for the propulsion of the blood from the heart; but even if it were admitted to be sufficient for that, still it, confessedly, fails to account for the force which draws it again into the heart, and the force which causes

the heart to contract and expand! No existing theory attempts to fully or satisfactorily explain that.

THE THEORY STATED.

The theory which I have deduced from my investigations is this:

Electricity is the motive power which causes the blood to circulate. The electricity is taken from the air which is brought into the lungs by respiration.

From the lungs a vast number of nerves run directly to the brain, and by these nerves, which are perfect conductors of electricity, the electricity is conducted to the brain. Each nerve is insulated by being surrounded by a membrane which is a non-conductor. At the brain each nerve terminates in a cell, which is, in construction, a tiny Leyden jar, and these cells are in fact a battery of such jars. From these cells two sets of nerves pass to the heart, one nerve proceeding from each cell, and each set, or system, of nerves being wholly distinct and separate from the other. One set goes to the right heart and one to the left, and the flow of the electric current is to each alternately.

To illustrate the application of the electric force to the circulation of the blood, let us assume that the electricity conducted to the heart from the brain is positive. Then, if the right auricle is charged with positive electricity, it will attract toward it from all parts of the venous system the particles of negative blood, and the result will be to fill the right auricle with blood. The blood there becoming, by contact, charged with positive electricity, will be repelled from the right auricle, and thence forced through the right ventricle to the lungs, thence to the left auricle, thence to the left ventricle, and thence through the aorta into the arterial system.

At the lungs the blood seems to undergo a marked change, in which it loses its positively electrified character. It would seem that at the same time that the postive electricity is taken from the air into the lungs to be carried to the brain, the positive electricity is also taken from the blood, and the blood becomes charged with negative electricity. Assuming this to be the case, the course of the blood in its circulation through the human system, and the application to it of the propelling force, are as follows: The venous, negative blood is attracted to the right heart, which is charged with positive electricity from the brain; there it becomes positive, and is repelled from the right heart, and passes to the lungs, where it becomes negative again. Becoming thus negative, it would be drawn back into the right heart by its positive attraction, but for the valves in the pulmonary artery, which close upon it, and the passage to the left heart being open, and the left heart being also positively charged from the brain, the blood is drawn from the lungs into it, whence it, becoming charged with positive electricity, is again repelled and passes out into the body through the arterial system, passing through the capillaries into the veins, whence it is drawn again to the right heart.

In passing from the arteries through the capillaries into the veins, a change takes place which affects both the character and color of the blood. The positive electricity is apparently taken from the blood, where it becomes an important factor in the process of combustion which is there being continually carried on, and it becomes negative again.

In addition to the direct attractive and repellant force exerted on the blood by the electricity, there is also, probably, a considerable muscular force exerted on the blood at the heart, by the alternate expansion and contraction on the walls of the heart; but this, instead of being a distinct and independent force, is the result of the passage of the electric current from the brain to the heart. This is shown by the common experiment of passing a current of electricity through a heart; and, indeed, in this experiment is found one of the clearest proofs of the correctness of the theory advanced in this paper.

I am satisfied, from my inve-tigations, that almost every phenomenon connected with the circulation of the blood, and the action of the heart, may be explained satisfactorily in harmony with this theory. The action of the heart in cases of death by hanging, where respiration has entirely ceased, and the action of the heart before respiration in infants, are among these. I also fully appreciate the fact that if the theory is correct it will not only explain almost every such phenomenon, but it must do more—it must explain or be in harmony with all. If it fails in a single instance, it cannot stand.

It is because of this, that for more than five years I have declined to make the theory public; and but for the request of some of the members of your society, I would not do so at this time. I had hoped, by myself, to complete the proof by which to approve or condemn it; but for want of time and of a sufficient knowledge of anatomy, I am unable to do so. I am, however, pleased to submit it to you, and trust you to put it to severer tests than I have been able.

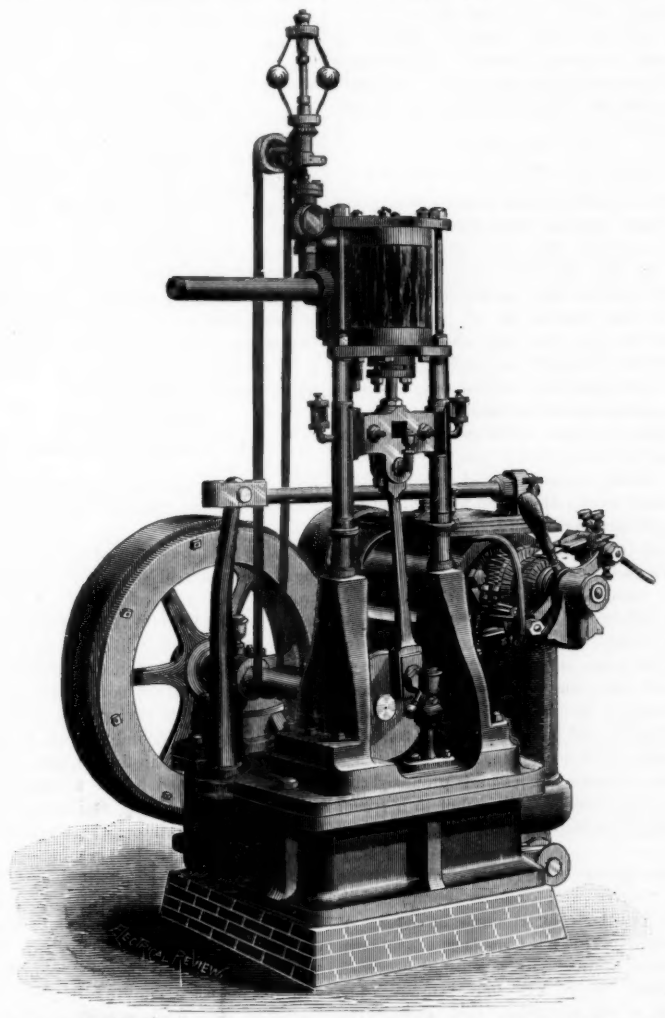

FIG. 2.—ANOTHER VIEW OF ELECTRIC STEAM PLANT OF YACHT "RESTLESS."

Electricity for Farming Purposes.

In a paper read by Mr. Rix, of London Colney, St. Albans, on "Harvesting," before the London Farmer's Club, says *Iron*, an interesting account was given by the lecturer of the employment of electricity as a motive power on the Hatfield estate, belonging to the Marquis of Salisbury. It appears that electricity is used at Hatfield for many purposes, the elevators for building the hay and cornstacks being worked by its means. Arrangements have also been made to thrash by electricity. The power is obtained from a water wheel in a central position, and carried by wires wherever it is required. Mr. Shillitoe, the resident engineer at Hatfield, supplies some details. He states: "We are using electrical power for pumping sewage for the purpose of irrigating the higher lands. This is most useful, as the power obtained from the river running through the estate can be had for nothing. We not only use the power for thrashing and for working the elevators, but we employ it at a much greater distance from the river—1¼ miles—for cutting the rough grasses into chaff for ensilage, which has proved a great success. The same power is also used at a farmstead, half a mile from the river, for grinding all the barley, maize, etc., for cattle feeding." It thus seems that there is no limit to the use of cheap electric power wherever work is required to be done, thanks to water power.

On a New Method of Exciting the Voltaic Arc, Without Previous Contact of the Two Electrodes.

BY M. G. MANEUVRIER.

We know that it is not possible, under ordinary conditions, to light a voltaic arc between any two electrodes which are separated by even the smallest possible space. They must previously be brought into contact, so as to ensure the passage of the electric current, and then gradually separated up to a maximum distance, which is always more or less short, and which depends principally on the available electromotive force.

This double necessity of previous contact of the electrodes and of their being kept within a fixed distance, greatly complicates the use of the voltaic arc and has considerably limited its scientific applications. Attempts have been made to obviate this drawback in two ways.

The two electrodes (for instance, two points of Carrè carbons) being connected to the two poles of the current generating apparatus, the flame of a candle is interposed between them; and after a little while, the arc shoots out. The more smoky and less oxydizing the flame is, the better does the experiment succeed. Another way is to cause to pass between the two points, either the discharges of a powerful electro static machine, or better still, the series of sparks from a Ruhmkorff coil; the voltaic arc is lighted at the end of a certain time, which is shorter according as the sparks are longer and more reiterated.

But these two methods, besides not being very practicable, are limited in their application to very short lengths of arc. Thus, with the apparatus which I employ, I have not been able to effect lighting by the flame beyond 7 millimeters. The maximum distance was yet shorter with the second process; I never exceeded 3 millimeters, although using the discharges of a bobbin of the largest type, the striking distance of which amounted to as much as 10 centimeters. Now, I can, on the contrary, produce the voltaic arc spontaneously, at increasing distances of 5, 10, 15, 20, 25, and 30 millimeters, by my new method of lighting, which does not necessitate the employment of a flame, or a condenser, or any kind of mechanism. I will now describe it.

I enclose the two electrodes, placed opposite one another, in a glass globe hermetically closed, and furnished with a tubing with a tap having three channels, by which I can, at will, exhaust the air inside, or introduce the outer air. The capacity of the closed globe depends on the diameter of the electrodes. In my experiments it varied from that of a large electrical egg, for carbons of 6 millimeters, to that of an Edison lamp, for carbons of 1 millimeter. The two electrodes being connected by platinum wires soldered into the glass, with a source of alternating currents, I rarefy the air of the globe until a violet effulgence, similar to that of the electrical egg, is produced. I then turn the tap so as to admit some particles of air. We then see the long, pale, effulgence suddenly become collected together between the points, under the influence of the sudden increase of pressure, and become instantaneously transformed into a voltaic arc of dazzling whiteness. The experiment is very fine, very neat, and most easily performed.

The degree of rarefaction to which the inner atmosphere must be brought in order to produce the effulgence depends a little on the distance between the points, but much more on the electromotive force of the source. I have never had occasion, in my experiments, to push the vacuum beyond from 5 to 6 mm. of mercury, even at the beginning, when the carbons are cold. As to the increase of pressure necessary in order to transform the effulgence into an arc, it must not be too great, as it would then cause total extinction and the experiment would have to be commenced afresh; but it may vary between pretty considerable limits. The final pressure, after the transformation, may extend from 30 to 150 mm. This enables the experiment of lighting to be repeated with great facility and with the certainty of success. The manipulation is most simple, as it consists in first giving a half-turn to the right, so as to produce a vacuum in the globe, and then a quarter of a turn to the left, in order to admit a little air; occupying only a few seconds.

Out of the methods of exciting the arc without contact which I have mentioned, only the last really deserves the name; the two others are methods of lighting with contact, more or less disguised. In fact, in lighting with the candle we may clearly observe the formation at the two points, as they become incandescent, of excrescences consisting of particles of carbon, which keep increasing in size and approaching one another; the arc is formed at the moment that the two deposits meet at some point. In lighting by discharges the sparks give rise between the two electrodes to a sort of current of particles of carbon, which become denser and denser, until at last they close the circuit, and then being rendered incandescent by the passage of the current, constitute the voltaic arc.

The very nature of the phenomenon, in these two cases, shows that it may easily be interrupted by any circumstances opposing this parasitic communication between the two points, particularly by the increase of the distance between them. But it is clear on the contrary, that with my method the lighting of the arc may theoretically be effected with any distance between the electrodes, provided that the rarefaction is carried sufficiently far, and, consequently, the electrical conductivity of the gaseous atmosphere introduced.

In conclusion, I will add that when once the lighting is effected we have only to close the globe in order to have a voltaic arc in a closed vessel, sheltered from the air and from combustion. This arc possesses remarkable steadiness, both as regards the intensity and quality of the light. The consumption is thus very trifling, as it proceeds merely from the wearing down of the carbons, and the projection of their incandescent particles. I will not dwell upon the practical applications that might be made of this apparatus to electric lighting as this point has no scientific interest. I will only remark that this method does away with all disturbances in the burning of the arc arising from combustion and from the continuous increase of length; they are reduced to a minimum; that is to say, they are limited to those arising from the more or less irregular rendering from the electrical source. We thus arrive at better conditions of stability and duration for studying the physical characteristics of the voltaic arc, for instance, its electromotive force and resistance. This experimental apparatus may therefore render good service to those physicists that occupy themselves with these questions.

ELECTRICAL REVIEW

Published at 13 Park Row.
P. O. BOX 3329.

GEO. WORTHINGTON, - - - Editor.
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SUBSCRIPTION.
United States and Canada, $3.00 per annum, in advance. Postage paid by publisher.
Great Britain and other foreign countries, $4.00, in advance. Postage paid by publisher.

ADVERTISING.
Transient, 25 cents per line, nonpareil.

DEALERS SUPPLIED BY
The Albany News Company, Albany, N. Y.
The American News Company, New York, N. Y.
The Baltimore News Company, Baltimore, Md.
The Brooklyn News Company, Brooklyn, N. Y.
The Central News Company, Philadelphia, Pa.
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EDITORIAL ANNOUNCEMENT.
Address all communications and make all Express Money orders, P. O. orders and checks, payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

NEW YORK, JUNE 4, 1887.

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If the new East River Electric Company, of New York, is to furnish its patrons with the Thomson-Houston electric light, the city will then be lighted by four first-class arc systems. It has been a matter of conjecture as to which system this company intended to adopt.

Our esteemed contemporary, the *New York Tablet*, now in its thirtieth year of successful publication, rises to remark, with true discernment, that "The ELECTRICAL REVIEW has moved into new and elegant quarters in John H. Cheever's building, 13 and 15 Park Row. The REVIEW is the leading authority on electrical news and science, and is the recognized organ of electricians and manufacturers of electrical machines and supplies in the United States."

Industries, of England, offered a prize of $1,000 last year for an electro-motor that would best fulfill certain conditions which were published at length in the ELECTRICAL REVIEW, October 9, page 8. Numerous competitive designs were sent in, not only from England, but also from Germany, Austria, Spain, France, the United States, South America, and Norway. The appointed jurors now make the following report:

After careful consideration of all the plans of motors submitted in the competition, the committee of jurors have come to the conclusion that the two designs marked "Agir" and "Ironclad" are those which specially commend themselves, both for mechanical and electrical perfection; and they are almost equally entitled to the prize. But, inasmuch as one of them is based on a principle that has not as yet received a practical test in England, the committee suggest that motors on each of these plans should be constructed, and that the award of the prize should be dependent on a test being applied to them.

With this suggestion of the jurors the proprietors of *Industries* state that they fully agree, and they will, therefore, arrange to have two motors constructed, without delay, from the selected designs, so that the results of the test may be made known as quickly as possible.

PATENT RIGHTS AND WRONGS.

There is a wide-spread belief—among the inhabitants of the rural districts it is almost universal—that the right of a patentee of his invention goes no farther than to protect him against the manufacture of the article, or of the patented process, for sale; that any individual may manufacture or apply any system or process for his own personal convenience, and that in this adaptation of another's ideas he is not infringing the rights of the inventor who has obtained the protection of the patent law.

It is in the minor classes of patents where this belief works the greatest mischief and wrong to the inventor. It is especially burdensome in the matter of some mechanical tool which the user constructs for himself. Under circumstances where the article is small, difficult to find, easily concealed, and withal cheap and readily constructed, too often the game is not worth the powder required to bring the offender to justice, and the inventor is defrauded of just reward for his labor and ingenuity in conferring a boon upon his fellow man.

A very wholesome lesson is promised this class of believers in the sequel to a recent decision of the Supreme Court of the United States.

In the spring of 1872 the owners of the Green "drive well" patents commenced a fight before the legal tribunals in defense of their claims. This fight has been as stubborn as it could be made by a most determined opposition. Step by step, slowly, but steadily, it was advanced, until now, in the court of last resort, the patent is sustained The original patent has expired. There was a re-issue, but that, too, is dead.

During these fifteen years, and for some years before, the honest granger in every State and Territory, and in every village and hamlet throughout the Union almost, has helped himself, and made his own "drive well," without so much as a "thank you" for the inventor. It is estimated that from 300,000 to half a million of these wells exist, which were constructed during the life of the patent. It is now the intention of the successful litigants to at once set about collecting a royalty of $10 on each well. There have already been about 15,000 settled for; but this is exclusive of the number mentioned above.

The inventor, Col. Green, is a resident of Boston, Mass., is in needy circumstances, and has, of course, parted with the major portion of his patent, long ago; yet the gentleman will be lifted out of the financial mire by this decision, and placed on dry land.

Aside from this, a great good will be accomplished by the lesson which so large a class will be forced to learn, that the patentee is protected in the sole right to make, use and sell the fruit of his brains, whether this be a tack or a trip hammer, an electrical appliance or a hole in the ground.

A meeting of the Executive Committee of the National Electric Light Association will be held June 10th, at which time the date of the summer meeting of the association will be determined. We understand that August 23d has been favorably considered by the committee.

BOOK REVIEW.

Descriptive List of Experiments in Physics, Harvard University, Cambridge, 1887. Sent on application.

This pamphlet of 52 pages, for the use of students fitting for the admission examination in elementary experimental physics, has been prepared by Dr. Hall. At the beginning of each exercise the apparatus required (usually of the simplest kind) is stated or directions for its construction detailed. Reference is made in part to Trowbridge's New Physics and Worthington's Physical Laboratory practice, and the directions in those books are supplemented. Dr. Hall is evidently fond of magnifying small changes by means of levers. Ex. 3.—Bending. A simple micrometer with battery and sounder would be an improvement over the method suggested. The same may be said of Ex. 25. Linear expansion of a solid. Ex. 31, first part. —Pitch of a tuning fork, the method of recording on the smoked glass, equal intervals of time by a small pendulum with bristle could, with a saving of time and a gain in accuracy, be replaced by an electro-magnet operated by a simple make and break piece attached to any pendulum clock. Harvard is doing good work in improving the instruction in secondary schools, and this pamphlet is a welcome contribution to the meager literature of scientific teaching.

OUR BOSTON LETTER.

(From a special correspondent of the ELECTRICAL REVIEW.)

Boston is a pleasant place, or why does the Legislature sit so long? Stiggins, the prophet of the third house, predicts final action on the bill allowing gas companies to supply electric light will be taken just before the close of the session two months hence; that the street railway committee will ask to be continued as a roving commission for a grand summer tour, and visit all the electric and cable railways in the country; that they have been detained by the hearings relating to the West End Railway Company, and want their legislative junket. Stiggins confidentially remarked that the feeling of the General Court is very favorable to electric railways.

The progress on the West End Company's railway consolidation bill is slow. Exhibitions of no less than three cars will be given within a month. The New England Weston Company have made very successful experiments with a car at the Cambridge railroad stables. A Weston shunt-wound motor is used, operated by current from storage cells. Five incandescent lamps of 16 candle power light the car, two of which lamps illuminate the bull's-eye.

The time is coming when electric light companies will be under the supervision of the gas commission or of a separate board. Such a change would be advantageous to producer and consumer It is said that the companies insured in the Manufacturers' Mutual Company receive in advice, suggestions, comparisons, etc., information worth far more than the premium charges. Many electric light stations are not visited by one competent to assist and give information to those in charge from one year's end to another.

The Hub, to the casual observer, appears to be behind the "country" in the matter of electric roads. We are conservative. The tangential inertia is greater far out on the spokes or the rim. The Woonsocket (R. I.) Electric Light and Power Company has increased its capital stock, purchased cotton mill property for additional station room, and will furnish current for the electric street railway which is to materialize during the coming summer. The company has plans and estimates for a complete gas plant and if the gas company enters the field of electric lighting, fireworks are expected.

Said Treas. Burnham, of the Electric Gas Lighting Co., "The interest in the practical and domestic applications of electricity is rapidly growing. The demand for supplies increases fully 50 per cent. every year, and the most hopeful sign is that they demand better and better goods."

The directors' room of the Boston Electric Lighting Company has been ornamented with a large mirror placed over the fireplace. The frame is of ivy wreath pattern, and in front there is an ornamental pot containing a fine specimen of the Vaultohonperaria Gilbertia. The whole is illuminated with 40 3 c. p. Sun lamps supplied with current from the converter. The effect is fine. The lamps are lighted and extinguished by a button at President Fred. Gilbert's desk.

"WLatever faults there may be in Boston's fire alarm department," remarked an insurance inspector from the city of fraternal love, "you are far ahead of us. The keyless box, the placing of keys in the hands of responsible persons located at definite points are advantages we do not possess. Our policemen have the keys and to ring an alarm one of those much-out-of-the-way-when-wanted individuals must be found. Some time ago a man noticed a fire, ran to the nearest box, of course could not open it. The bystanders coolly told him to find a policeman. He found an axe, broke the door and pulled in an alarm. He was arrested, but the case was dropped when explained to the judge."

"Speaking of hand grenades," continued our friend, "the composition of the liquid is water, salt, sodium sulphate, sal ammoniac, etc., all of each that can be dissolved by the water. The solution is slightly more effective than an equal amount of pure water. A bucket of water is equal to two dozen of them. Water buckets combined with an automatic fire alarm system give excellent protection."

Steps are being taken towards the formation of an electrical association in Boston. Organization will be effected by fall. The number of persons interested in electricity in the city and vicinity is estimated as over two thousand, and there will apparently be little difficulty in bringing together a body of experienced practical and theoretical electricians. There are students pursuing the study of electrical engineering at Harvard University under Prof. Trowbridge, at the Institute of Technology under Prof. Cross, at Tuft's College under the direction of Profs. Dolbear and Hooper.

A large electric light company recently moved into new quarters. It was given out that to gain admittance to the manager a card accompanied by a champagne cork must be sent in One morning a friend called and did so, using a cork as large as a stovepipe hat. Not long after a newspaper man in search of sensations discovered this fact and departed happy that he had an exclusive item. He was followed soon after by his rival, who saw not only the cork, but the carbonated ethyl hydrated liquid as well. "Was that the breaking of an incandescent lamp I heard?" "No That was merely an air pulse due to the removal of a bark stopper from a vitreous receptacle."

The American Rapid Transit Company intend to open, July 4th, two miles of electric railroad in South St. Paul, Minn., on the Enos system.

The Tremont Electric Company's lamps have been recently tested at the Institute of Technology. They required on an average 44.9 volts, 1.03 amperes to bring them to their normal brilliancy 16 c. p. Each lamp then required about 46 watts, thus giving over 16 lamps per electrical horse power.

Boston, May 30.

A Paper Read by Mr. M. M. M. Slattery, of Woburn, Mass., Before the Society of Arts, Massachusetts Institute of Technology, May 26

It is generally admitted that in the history relating to the various branches of industry in this country, there is no branch which has shown so much intelligent activity, energy and enterprise as that of electric lighting. And in reviewing the efforts of the past five years there is cause to wonder not so much at the innumerable improvements which have developed from time to time, as at the completeness and boldness with which these improvements have been placed at the disposal of the public. From the time of the first great efforts of Chas. F. Brush, the pioneer of the commercial arc light system, to the latest outcome in the same direction; from the days of Edison's first attempt to make incandescent lighting commercially successful down to its present stage of perfection and utility, improvement after improvement has followed in such rapid succession that our sense of satisfaction at having placed within our reach one of the most valuable acquisitions to modern civilization is only equaled by that produced by its rapid growth and its many opportunities for application.

We all, no doubt, recognize that the year 1878 will ever be memorable in the history of electric lighting, for the reason that the first real practical developments took place in that year, and although the efforts of that time may seem to shrink into insignificance by the side of perfected work that we may now see around us on every hand, yet in that year the proper direction in which to work was truly outlined and indicated in a line of action pointed out which was subsequently followed up by the two gentlemen referred to with a persistence and ingenuity which must ever elicit our admiration and respect.

However, as time rolled on and the magnitude of the work began to assume considerable proportions, it was found that the arc system of lighting outstripped the low tension or incandescent, principally because the problems involved in the respective systems were very much simpler in the one case than in the other. In the latter case, the necessity of having to deal with very heavy currents, the equal distribution of these currents through the system, required all the ability that the practical engineer could bring to bear upon the work to be done, to do it in such a manner as to keep that work within the limits of a profitable commercial undertaking, and how ably and well that work has been done is evidenced by the superb and gigantic undertakings that are being continually carried out.

Notwithstanding the successful undertakings on the part of the low tension advocates, the time has now arrived when, in consequence of the enormously increased magnitude of the demands of the public for a more general extension of incandescent lighting, we find the necessity imposed upon us, in order to meet those demands, of making some radical departures from the line in which we have hitherto been working, or on the other hand, neglect the public's requirements and confine our operations within certain narrow limits. The object of this paper this evening will be to endeavor to show the advantages of the use of a system of electrical distribution by means of induction coils, and how nearly such a system fulfills the necessary practical, economical and commercial conditions imposed upon it. As has often been remarked, in low tension incandescent lighting as hitherto carried out, there are two fundamental objections which present themselves to the practical electrical engineer [unless, indeed, the exuberance of his enthusiasm excessively exalts the efficiency of his especial enterprise which he expects will never be excelled]. These are, first, the enormous mass of copper conductors necessary to carry the current to the desired distance without a very prejudicial loss, and second the necessarily short distance from the source of current generator to which that current can consequently be conveyed. Now, in a system of incandescent electric distribution by the aid of induction coils these objections may be so greatly modified as that we may consider them as almost wholly removed. It is well known that the higher the electrical pressure at which we work the smaller need be our conductors, and the longer may be the distance between the source of current and the points of electrical distribution.

Coupled with these two important elements must also be the one of such flexible subdivision and distribution as are offered by the beautiful low tension parallel arc systems now in use. The efforts of many explorers have been directed towards securing each of these essential features. In 1883 one of the most successful of these explorers suggested the proper disposition of induction coils in a system of this kind, *i. e.*, in multiple arc. If this gentleman had gone a little further and given us some definite ideas as to the best proportions and construction of the coils, his suggestion would have been of more practical value, but as he left that important part of the subject still in the background to be worked out by patient experiment, the brilliancy of the idea possessed a somewhat nebulous luster.

The suggestion of the true line in which to work was undoubtedly an important step in the right direction, and experimenters set themselves to work to overcome the various mechanical difficulties which presented themselves as obstacles in the way of success. These were from time to time removed, until at the present moment the system of electrical distribution by aid of induction coils stands as embodying all the advantageous characteristics of the low tension, and as having eliminated the objections to short distance transmission with massive conductors. We find that the first difficulty which the worker had to overcome was how to proportion his copper and iron in the coil, so as to secure the best results, and so to combine such proportions as to obtain such an automatic regulation in the coil that the potential at the terminals of the lamps should be maintained constant, or nearly so, no matter how much the load upon the coil might vary. It was an easy matter to calculate the loss in the copper, knowing the resistance and the current carried; but it was not so easy to determine the number of convolutions and the quantity of iron necessary. It was found by experiment that many of the rules which guide the best manufacturers in the construction of dynamo machines could be applied in the construction of these induction coils, *i. e.* to say, the loss on the copper wire must be as little as possible, for obvious reasons, and that, as in the case of the field of the dynamo, you must keep well below the saturation of the core; the magnetic circuit must be as short as possible. Should you depart from these rules, lack of regulation or efficiency would follow. Here is a coil in which the core is over-saturated when working at full load, which I intend to put upon it. I may say just here that Mr. Fred. Gilbert, the courteous manager of the Boston Electric Lighting Company, has been good enough to give us current this evening from the company's city circuit, and for the first time in this branch of lighting we are able to show practical exhibition from a practical operating commercial plant. There are on this coil twenty-five 16-candle power lamps; they are 50-volt lamps, and take 1 ampere. The units of the coil, and of the circuit in which it is working, are, at poles of dynamo, 1,080 volts; at poles of primary of this coil, 1,050. The current in the primary with 25 lamps on is 1¼ amperes. There are 50 volts at the poles of the secondary, and 25 amperes in that circuit. The resistance of the primary coil is 16 ohms; the resistance of the secondary, .059. We find, therefore, that we have 3 per cent. loss in main line, and 5 per cent. loss in the induction coil. This is equal to a loss in the system of 8 per cent.—not an excessive one, by any means.

The regulation of this coil that we are now speaking of is, as you will notice, very poor, because the core is supersaturated, making the magnetic resistance high. The proportion of loss due to the electrical resistance of the wire is the same in all three coils here. The law of self-inductive resistance, or, as it is sometimes called, counter electromotive force, is a most beautiful and accommodating one For instance, in this coil, in the primary circuit we have an electrical resistance of some sixteen ohms, and, as the pressure at the terminals of that circuit is 1,050 volts, we should be taking, not 1¼ amperes but some 65 amperes, if it were not for this something which enables us to take just what current we require. Now, as we are, in fact, only taking 1¼ amperes at a pressure of something over 1,000 volts, we must necessarily have, somehow or other, a resistance, electrical or self-inductive, of a little over 800 ohms; and, in point of fact, that is what we have, and it is made up of the resistance of the wire 16 ohms plus the resistance of self-induction or counter pressure. To illustrate how admirably this law works when variation in the circuit take place by cutting lamps out, we have placed there one 50 volt 1 ampere lamps in the primary circuit. It will now be noticed that as lamps are switched out of the secondary circuit the lamp in the primary will grow dim. Showing that as the resistance in the secondary circuit increases by reducing the number of lamps, less current is flowing in the primary. A few words will explain the action. Take a core of iron and wind thereon a primary and secondary coil of an equal number of ampere turns, connect the ends of one coil with a source of alternating current and close the other through an object of low resistance. The energy in both coils will then be almost equal. In this case the resistance of the primary will be merely that due to the conductor itself, scarcely any inductive resistance being present, there being an absence of any free magnetism or polar development. The current impulses it will be understood, are circulating in the coils simultaneously and in opposite directions, so that the magnetic field that would be developed by one impulse is at the same instant counterbalanced by an opposite impulse, and the self-induction of the primary is suppressed or neutralized. Here is an illustration of that law. This is an iron core having two coils of an equal number of ampere turns. The primary is placed in series with the incandescent lamps in the secondary circuit of this coil. Now as long as the secondary circuit of this subsidiary coil is closed the lamps with which it is in series will burn at almost their ordinary incandescence, but the moment the secondary of the subsidiary coil is open the lamps grow dim. The reason is obvious. So long as the energy in both coils is equal there exists no self-inductive resistance. When, however, the energy is greater in the primary than in the secondary, the resistance due to self-induction follows. This development of counter E. M. F., or self-inductive resistance, is just the condition of things that should and does prevail in these coils that we have here tonight. So that if we now call this a 20 lamp coil, when we turn out all the lamps but one, there should be a resistance of some 21,000 ohms plus the small electrical resistance of the wire. The evidence of that is, this one lamp in the secondary circuit of this coil only takes one ampere, therefore, there being nothing else in the secondary circuit of the coil, there should [and by the construction of the coil there can] be only $\frac{1}{20}$ of an ampere in the primary circuit. Now we have shown that on the proper full load, 20 lamps, only 1 ampere is required in the primary circuit, and consequently with double the resistance (10 lamps) in the secondary only ½ an ampere would be required (at constant pressure be it remembered) in the primary, and therefore [the neutralizing current in the secondary being reduced by half] there would be double the self-inductive resistance in the primary, 2,000 ohms and 80 on until with the same pressure there will be $\frac{1}{20}$ of the current, and thus we have 20 times the resistance in the primary. Therefore we get 21,000 ohms of effective resistance in the primary circuit, or 1,050 volts, 21,000 ohms, $\frac{1}{20}$ ampere.

We were speaking a short time ago of this particular 20-lamp coil not being good in the sense of regulation with the extra load put upon it, because we too nearly approached the magnetic saturation point of the core. Magnetic circuits are like electrical circuits in some respects. If you overload a wire you will have a certain loss; and in the magnetic circuit the same general principle holds good. Here is a coil—a 12-light coil—which is constructed with due regard to the loss in the wire and other wasteful effects, and, as you will observe, the regulation is very close. At this point I should like to express my opinion, contrary to that expressed by several workers in this field recently, that in actual practice there is no such thing as absolutely theoretical regulation. It is well enough to talk about; but, commercially speaking, it is impracticable. However, the very slight variation, which you may or may not be able to notice in this 12-light coil as between full load and one or two lamps, is from a commercial point of view quite good enough. True, almost perfect regulation is only a question of putting metal enough into the apparatus, but not to such an extent as would commercially preclude its use. Again, in any extensive system of distribution it is an easy matter, so far as maintaining an even pressure at the lamp terminals throughout the lamp circuit is concerned, to establish centers of distribution, and to provide feeders and compensating devices for these centers. In the case of such a system the wiring problems to be worked out would be very much the same as in the case of ordinary low tension supply, the requisite being to keep the working pressure throughout the system constant. In the plant, however, from which we are now being supplied there are no feeders or centers of distribution at present, nor in all probability will there be for some time to come, as the object has been hitherto to avoid this complication by keeping the loss in the main line very low, so that connection may be made with the mains at any point throughout their length. I was at a town in Connecticut a few weeks ago. There is a large induction coil plant in operation there. They make a large center in the lighting portion of the town; the system works fairly well, but rather heavy fluctuations in the light of the lamps occur at certain times and places in the course of the evening. This would indicate not a very close regulation of the coils, but with feeders and compensating arrangements that evil may be entirely done away with.

I notice that there is a rapidly growing desire for some means of measuring the energy supplied to the users of this alternating current. I am pleased to say here tonight that means are at hand for meeting that requirement, and in a short time a device will be in use that in effect shall rival the delicacy of electrolytic action itself, at the same time far exceed it in accuracy. Much has recently been said concerning the difficulty of running alternating dynamos in multiple arc. While some have said they have done it, no one has given us any precise particulars as to what latitude we may allow ourselves with regard to varying speeds and E. M. F. in doing it. I have lately had occasion to try some experiments in this line. I had in operation upon separate engines 2 400 16 c. p. lamp dynamos; one of the dynamos was running 400 lamps, the other 25. All the lamps were upon induction coils. The dynamo working at full load was making 1200 revolutions per minute, the other 1250. This last machine had a difference of potential at its poles of 1060 volts, the other 1000 volts. By means of a switch the two armatures were suddenly thrown in multiple arc; for a moment there was a slight sag of the belt of the lightly loaded armature, there being a momentary tendency on the part of the heavily loaded armature to drive the other in the opposite direction as a motor; instantly, however, both machines fell into step, evenly dividing the load between them, both delivering at exactly the same pressure. This experiment shows us that we may allow ourselves considerable latitude in regard to speed and E. M. F. in coupling alternating dynamos in multiple arc. When switching an armature out of circuit when two or more are running in multiple arc, it was found desirable to have a small bank of lamps in circuit with the armature we wish to cut out, in order to prevent any hurtful effects, because at the moment of cutting out the armature, circuit would be open, and the field being fully excited there would be an infinite resistance in the circuits, the volts would therefore have a tendency to rise to a dangerous degree, but a bank of lamps across the poles prevents that occurrence. A good deal has been heard within the last few months of self-exciting alternating machines, as if there were something very original and advantageous about them; as to the originality it is decidedly problematical, and in my opinion the advantages, such as they are, are on the side of the separately excited machine. There is no great difficulty in making a self-exciting alternating machine. On the other hand, without going into the whole merits of the question, which time forbids me to do on the present occasion, I will simply say that the construction of self-exciting alternate dynamos is quite familiar to many of the best continuous current dynamo manufacturers. The objections to them, or to any shunt wound high tension dynamo of 1000 volts or upwards, it is an expensive machine to build, and in the event of the dynamo fusible plug for the main line giving way when at full load, in consequence of a dead cross of the line, it will be a rare circumstance if the machine is not destroyed, because at the moment of rupture of the main, the volts at the dynamo will rise enormously and the current will discharge itself through some vulnerable point in the machine.

I find that it is necessary for me to apologize for not having entered more minutely into the subject of electrical distribution by the aid of converters. I feel and know that I have left many important points untouched; however, one of the principal objects of this paper will have been attained if I shall have succeeded in directing some increased thought towards this growing branch of electric lighting—a branch that I believe, in time, will take precedence of all others, as it brings electricity in its most flexible and utilizable form, and by comparatively cheap means, within the reach of all.

Latest Action of the Electric Club.

The meeting of the Board of Managers and special building committee of the Electric Club, Wednesday evening of this week, resulted in the selection of the four-story and basement brown stone building, No. 17 East 22d street, just off of Broadway, for the use of the club, and the proper officers authorized to execute lease. The building rents for $4,000 per annum; ten year four per cent. bonds to the amount of $25,000 were ordered issued, all of which will be taken by members of the club. The full committee will meet again at 7.30 P. M., Thursday, June 9.

—— A practical electric light manager suggests that in those cities where companies that have neither plant nor franchise desire to come in and under-bid, a contract for five years, requiring bonds in amount equal to contract, should be exacted. This would simplify matters, and prove good faith.

Telephonic News

*** American Bell Telephone Company stock is now quoted at 230; New England at 44; Erie at 35½.

*** The telephone exchange at Los Angeles, Cal., has 650 subscribers. Telephone business on the Pacific coast is good.

*** The work of removing the telephone wires from the poles has commenced in Brooklyn on lines where a conduit has been put down. The telephone company of that city will soon have on hand a number of very straight, handsome poles, ranging from 40 to 70 feet in height, which will not be needed in the business.

*** Mr. Knud Bryn, general manager of the Christiania Telephone Company, Norway, and Mr. Ludvig Spörck, also interested in electrical matters, are visiting this country investigating recent progress in electric lighting and the general electrical business. The REVIEW is indebted to them for a pleasant visit. The telephone exchange at Christiania has over 1,600 subscribers, and the company operates in addition a large number of suburban exchanges, comprising an extensive business.

*** W. L. Bishop, lately division manager of the Western Counties Telephone Company, of England, has accepted the position of manager of the Savannah Exchange, of the Southern Bell Telephone Company. Mr. B. F. Dillon, the former manager, has been promoted to the position of superintendent of the International Ocean Telegraph Company at Jacksonville, Fla. Mr. E. E. Bawsel, formerly assistant manager at Savannah, has accepted the position of manager of the Rome (Ga.) Telephone Exchange.

*** It will be remembered that a syndicate is now introducing the telephone into China. It is not altogether certain how the telephone will be received in China. A language that has 50,000 characters in its alphabet may find the resources of the telephone severely tried before an ordinary conversation is concluded. But as Chinese words have usually the merit of brevity, there is not the danger of tangling the wires in inextricable confusion that there would be if Russian, for instance, were the vehicle of expression. It will be interesting to await the result of this experiment in inducing the sad-eyed Mongolian to pour out his monosyllables over the telephone wire. He will never really appreciate how utterly insufficient is mere human speech to express deep-seated emotion until he has rung the little bell for eleven minutes continuously only to have the amiable girl at the central office then cheerfully require, "Did you ring?"

*** The Bell Telephone Company, of Buffalo, has decided that the creosoted wooden box is the most practicable for underground work, and at a recent meeting of the directors adopted the following:

Resolved, That the general manager of this company be authorized, under the direction of the executive committee, to procure the necessary materials and proceed as rapidly as possible to construct two miles of underground conduit, in accordance with the terms of the grant from the city.

No propositions have been received from the telegraph companies for joint use of the conduits, and it is thought that the electric light wires cannot be run in the same conduits with other wires. The first two miles of conduit will be laid in the business center of Buffalo and cost from $8,000 to $10,000 per mile, exclusive of house connection. As soon as the plans and specifications have been prepared the company will advertise for proposals for excavating and repaving. It is expected that the conduit will be laid during the summer.

The Bell Telephone Case in the Patent Office.

Principal Examiner Brown of the Division of Electricity, in the Patent Office, heard argument last week on behalf of Prof. Alexander Graham Bell in opposition to an application of Prof. Elisha Gray for permission to amend his original application for patent in the celebrated telephone interference case of Bell, Gray, Edison, McDonough, *et al.*, upon which a decision adverse to Gray was rendered in 1879. Mr. Roscoe Conkling and Mr. James J. Storrow, of New York, appeared for Bell, and Mr. Casey Young, of Washington, appeared for Gray. The latter declined to make any argument in support of his application, on the ground that the law and the rules of the Patent Office provide that all pending applications for patents and all amendments must be kept in the secret archives of the Patent Office until an interference is either declared or refused. It was insisted that no notice should have been given to Bell or to any one else of the pending application in this case, as was done by Examiner Brown. Mr. Conkling, on the other hand, declared that the efforts of Gray's counsel to prevent a full hearing in the case were "scandalous in the extreme, and without a precedent in the history of the Patent Office." One of Gray's original claims was for "a telephonic receiver, consisting of the combination in an electric circuit of a magnet and a diaphragm supported and arranged in close proximity thereto, whereby sounds thrown upon the line may be reproduced accurately as to pitch and quality." The change or amendment now proposed is to insert the word "metallic" before the word "diaphragm" in the above. It is stated that if the application is granted the amendment will so broaden the scope of Gray's invention as to result in a new interference, and hence in a reopening of the whole case, in which, in 1879, Bell was declared to be the prior inventor. Decision was reserved.

The Influence of Magnetism Upon Chemical Reactions.

This is a subject of very considerable interest, and one in which, although very little work has yet been done, will probably well repay systematic investigation. The effects described below are not, we believe, absolutely new, although they are recorded by M. Colardeau in the last number of the *Journal de Physique*, and evidently under the impression that they are now given for the first time. But even if this be not the case the results will bear repetition. M. Colardeau takes a thin sheet of iron, underneath which the poles of a powerful magnet are placed. Copper is then deposited upon the iron from a solution of sulphate, when it is found that the deposit, instead of being of even depth over the surface, is cut up into numerous ridges. These ridges do not follow the magnetic lines of force, but are at all points orthogonal to those lines; they are, in fact, lines similar to those which the same investigator has found to be traced out by substances of low magnetic power when strewn in the form of powder over the magnetic field. The hypothesis by which M. Colardeau at first attempted to explain the effect was the following:—The deposit of copper from the solution of sulphate is in itself (in all probability) an electro-chemical phenomenon, and may be considered to be due to a great number of extremely minute local couples, between which currents of electricity actually circulate. If this be the case, then these currents, under the influence of the magnet, will set up minute eddy currents in the liquid, which currents will be directed normally to the lines of force, and copper will be deposited chiefly along such streams. If, however, this explanation be correct, the plate of iron plays no necessary part in the reaction, or at least it might be replaced by a sheet of some other metal which is capable of reducing a copper salt. Acetate of copper and zinc should, for instance, give the same results; but, on making the experiment, a perfectly uniform deposit was obtained, and no trace was visible of the magnetic field. The first hypothesis must therefore be abandoned. The following considerations lead, however, to the establishment of a more consistent theory:—We know already (and a reason has been assigned in the note quoted above), that substances of low degrees of magnetic permeability tend to distribute themselves in the magnetic field in lines orthogonal to the lines of force. Now, during the chemical action, while copper is deposited, sulphate of iron is formed; but sulphate of iron is a substance of low magnetic permeability, hence it tends to form liquid filaments (if the term be permissible) which will lie along the direction already indicated. These filaments will exert a protecting influence upon the iron underneath, and will cause the copper to be deposited in ridges between them, and following, therefore, the same lines of direction. If this explanation be correct, the formation should be prevented by keeping the liquid in a state of agitation; and this is found to be the case. But M. Colardeau goes further than this, and renders the formation of the liquid filaments actually visible. In order to do so it is merely necessary to employ some salt of copper whose color differs very distinctly from that of the corresponding iron salt. The best effect is produced by means of an alcoholic solution of bichloride of copper, which is green, while ferrous chloride is a deep yellow color. The striæ formed by the iron salt are then clearly visible.

Regulating Telephone Rates.

The committee on mercantile affairs, Massachusetts Legislature, has reported a bill to fix telephone rates. Senators Alger, of Middlesex, and Cook, of Essex, and Representatives Taft, of Palmer, and Boyden, of Foxboro, dissent. The bill reads:

Sec. 1. No individual, company or corporation, now or hereafter owning, controlling or operating telephone lines in this State, shall charge for the use of a telephone except as follows: In cities having at the last census a population of 100,000 and over, a sum not exceeding $6.50 per month shall be charged; if less than 100,000 and more than 50,000, not exceeding $4 per month; less than 50,000 and more than 10,000, $3.50; towns of less than 10,000 $3.00.

Sec. 2. Any person or corporation violating any provisions of this act shall be deemed guilty of a public offense, and on conviction shall be fined a sum not exceeding $25.

Sec. 3. This act shall take effect July 1, 1887.

Underground Work in Pittsburgh.

Henry Metzger, of the telephone company at Pittsburgh, and S. A. Duncan, of the electric light company of the same city, have appeared before the Pittsburgh committee on underground wires. Mr. Duncan stated that it would be utterly impracticable for the light or telephone companies to change their systems at once, and reiterated Mr. Metzger's statement that these companies were solving the question themselves by adopting the underground system as fast as its success warranted. The electric light company had not experimented in this line very extensively in this city, he said, but proposed, during the present summer, to lay a line of underground cables. Mr. Duncan did not favor the idea of a large conduit, built to conduct the different telephone, telegraph and electric light wires, as the induction from the many wires, which even now overhead is a source of trouble, would be largely augmented and seriously interfere with the business, especially of the telephone companies. "Let the city try the experiment, and put her own wires underground," he said, "and give the system a chance before private parties are compelled to go to enormous expense for what, at best, is a risk." He looks upon the proposed ordinance as unjust, and predicts endless trouble in the matter of torn up streets, and a continuous fight for the right of way. In regard to the retardation of the electric current in the cables, Mr. Metzger showed a sample of a seven-wire cable which his company had to abandon, as it could not be used in connection with overhead wires. The question of amending the ordinance making the laying of underground wires obligatory only in certain parts of the city, was talked over, and it is possible that that will be done

The Telephone in Massachusetts.

It does seem that the telephone has "come to stay" in Massachusetts, according to what the Boston *Transcript* says:

"That 'annual blister,' the Telephone Rate Bill, which is to come up to-morrow in the House of Representatives, ostensibly takes its origin this year in a petition, numerously signed, which, upon examination," says the *Transcript*, "is proved to chiefly bear the names of persons who scarcely use the telephone. Against this has been presented a remonstrance, signed by over 1,700 subscribers to exchanges in various parts of the State, who object to any legislation on the subject of telephone rates. Successive Massachusetts Legislatures have reported such measures as unwise, unpolitic, and contrary to the spirit of our laws, and the same may be said of the legislatures of a majority of the States in the Union." We said the same of a similar bill in our legislature, which was, a few weeks since, defeated. This running to Congress and legislatures with every petty or great business matter, formed, *ex parte*, into the shape of a grievance, for regulation by law, is unwise in the extreme. If the telephone is too expensive for use, it will not be used. The fact is, it must not be too expensive in order to get patrons. It is worth about what is now charged for it, and when the patent protection expires, competition will reduce its cost. Then there will be no "royalties," or "privileges" to pay for, and the service will be cheaper.

GENERAL BUSINESS NOTES.

The New Haven Electric Light Company is again increasing its electric light plant. More power is required, and a new Armington & Sims engine has been ordered through the Jarvis Engineering Company at Boston.

The Dallas and Oak Cliff Elevated Railroad Company, Texas, capital $400 000, has been incorporated to build an elevated railroad, by T. L. Marsalis, Thomas Field, J. T. Dargan, J. T. Elliott, W. J. Storms, Frank Field and others. The cars will be operated by cable or electricity.

L. C. Kinsey & Co., Williamsport, the storage battery men of Pennsylvania, have just closed a contract at Bethlehem, Pa., for a plant of 1,000 lights. The storage batteries will be charged from the arc circuit. Negotiations are about completed for a plant of 2,000 lights at Allentown, with the necessary storage batteries.

The William Lang Company, large manufacturers of metal goods, are now giving considerable attention to the manufacture of such goods as are needed in electrical work, such as dynamo parts, brass, sheet-iron, stamped and dropped copper, etc. Their very complete establishment on Middleton street, Brooklyn, is well fitted for such work, and electrical manufacture can only be benefited by having such houses enter it.

The Central Electric Company, of Chicago, although newly organized, is meeting with great success in securing electric work. This company controls the Hess guest call and fire alarm for the State of Michigan, and has just closed a contract to fit up Plank's large hotel at Mackinac Island, with this call. There are 350 rooms in the hotel, each of which will be fitted with a call. The McKinlock Bros., who are at the head of the Central Electric Company, are greatly pleased with the encouragement they have received since opening their Chicago house.

The Empire State Flint Glass Works—F. Thill, proprietor—are manufacturing over 7,000 incandescent bulbs per day. This is a remarkable showing of the incandescent business. For one electric light company alone—the United States Company—they manufacture on the average $3,000 worth per month, and last month sent $1,500 worth to the Westinghouse Company at Pittsburgh. The Empire Glass Company also manufacture glass tubing, large quantities of which are used by electric companies. They average in tubing about 4,000 pounds of tubing per week.

History of the Simultaneous Transmission of Messages by One Line Wire.

The recent issue of the *Journal* of the Society of Telegraph Engineers contains the following abstract of an article which appeared in *La Lumière Electrique*, October 23, 1886:

"In an English patent, No. 12,959, of February 7, 1850, Highton points out the possibility of using ordinary battery currents for working the instruments, whilst currents from electro-magnet generators might be used for actuating sounders. Werner Siemens, in 1856, proposed the simultaneous sending of ordinary battery currents, and of alternate currents produced by a magneto-inductor, over the same wire. The ordinary currents would act on any electro-magnets in the circuits; but these latter would be unaffected by the alternate currents, which could, however, act on an electro-dynamometer used as a relay. Isham Baggs, in 1858, took out a patent for an arrangement for triple working. He used a magneto-electric current for deflecting a needle, a very powerful current which could have a chemical action on prepared paper, and very high tension currents, which could perforate holes in paper strips. The patent of Hughes, taken out in 1858, is also for the combined use of battery currents and of induced currents. In 1871, Whitehouse proposed to make use of earth currents, in conjunction with battery currents, each actuating its special instrument. As he puts it, the earth currents can be compared to the deep waves of the sea, slow and gradual in their motion, while the battery currents resemble ripples on the surface. Varley's patent, No. 1,044, of 1870, is the forerunner of a great number of subsequent apparatus. He made use of rapidly undulating currents, superposed on the ordinary currents, the former actuating special harmonic sounders. In 1876, Elisha Gray patented a combination of harmonic telegraphs, with ordinary Morse instruments, which, in 1878, was modified by the introduction of telephones in the place of harmonic telegraphs. It is to the patent No. 1,477, of 1879, taken out by Messrs. Black and Rosebrugh, that we have to look for the first arrangement of two parallel telegraphic wires as a telephonic circuit. The telephones are interposed between the earth and a condenser, which stops the battery currents while it allows the passage of the undulatory telephone currents, and of alternate currents for ringing up. In this same year, 1879, we have Edison's American patent, No. 217,781, in which an arrangement is described capable of producing three variations of current. There is a key for reversing the current, a second for making variations in the strength of the current, and a vibrating reed for producing an undulatory current. Field's American patent, No. 242,411, of 1881, treats of a sextuple telegraph; two keys vary the intensity of the current, and a third produces harmonic vibrations; the receiving instruments are arranged to answer to each kind of current. Coming now to more modern systems, we have Van Rysselberghe's plan of combined telegraphy and telephony; similar plans by Maiche and Van der Weyde; a combination of the telegraph with the phonophore, by Langdon Davies; and two duplex telegraphic systems, one by Edison and the other by Rosebrugh."

The Produce Exchange "Jiggers."

A new "jigger" went up on the board of trade yesterday afternoon, says the Chicago *Mail*. About a year ago it occurred to an electrical expert that a "dial" placed in a prominent part of the exchange hall, that would show the fluctuations of wheat, would save a myriad of questions. He made the suggestion to a fellow expert—Roberts, of the Chicago *Times*—and between them they devised the dial, popularly dubbed "jigger," which now on the Produce Exchange both at Chicago and New York exhibits the prices as quickly as they are made to persons outside the pit as well as in it.

The "jigger" which is now prostituted to the duty of exhibiting prices on the New York and Chicago exchanges, was originally devised for no such commonplace office. It was gotten up twenty-two years ago in Boston by Tom Edison and Roberts to record the votes of the members of legislative bodies, the two young men having the crazy notion that a "vote recorder" which would silently and exactly indicate the ballots of senators, congressmen, legislators, and aldermen would make the patentees rich. The "vote recorder" of 1865 was elaborated and patented. It was possible with it for a legislator to touch an "aye" or "no" button on his desk on a roll call, and instantly, without his opening his mouth, his name was printed on the "aye" or "no" column of a sheet on the presiding officer's desk. The device worked beautifully. It was built at Charley Williams' famous electrical model works in Boston and cost $300. Roberts had to pay the entire bill, as he was the manager of the American Telegraph office in that city, while Tom Edison was only a lank and unkempt telegraph operator in the same office, with no money and no credit. The "vote recorder" was built and paid for and worked without a hitch, but no legislative body wanted it. The two enthusiastic inventors discovered that they had missed altogether the American legislator's idea when they thought that he was anxious to have his vote recorded in silence, unembellished by explanations or eloquence of any sort. Roberts made a herculean effort with Smith Weed to have the "vote recorder" put into the new capitol at Albany, but failed. Then Edison assigned the "right and title" to his one-half interest, and the invention was forgotten.

It was not until last year that the "vote recorder" was thought of again. Then it occurred to the electrical expert who has charge of the Board of Trade ticker service that if the Roberts and Edison invention could keep track of legislators' votes it certainly could keep up with the market fluctuations. It needed only a suggestion to Roberts to set that gentleman at work. The old "vote recording" model was brought out from its resting place and dusted off. A little work and a little adaptation soon put it into its new line of duty, and one day when the wheat speculators came down town they found the "jigger" at work in the gallery of the exchange hall. It worked so well for wheat that another was put up for corn, and another will soon be at work for the benefit of the speculators in pork. Roberts has just gotten back from New York, where he put up for the Produce Exchange one of the machines for the New York speculators.

A quaint New Englander fifty years ago grew rich because the sugar planters of the West Indies seized upon his cargo of warming pans for sugar evaporators. It seems not at all improbable that Roberts may realize handsomely, now that produce speculators see in that wonderful project of Edison's for silently recording the ballot of the eloquent American legislator something that can be made valuable to them.

Electricity as a Safeguard Against Collisions on the High Seas.

In an able editorial on the recent collision between the Britannic and Celtic, the *Boston Herald* says:

Assuming that two steamships are, under such conditions, approaching each other, each going at a speed of fully twenty miles per hour, thus covering the space that separates them at the rate of a mile in a minute and a half, and it becomes evident that the possibilities of a collision are not adequately provided against by any of the appliances that modern science has supplied to our sailors. Under the conditions we have referred to, it becomes very largely a question of luck. If the hulls of all vessels are constructed of steel or iron, as they doubtless will be before long it might be possible, by the use of electro-magnetic devices, to receive a warning of the coming of another ship within a range of three or four miles of the vessel upon which the aforesaid apparatus should be placed. Indeed, it is not impossible that electric science will be so far developed as to render practicable telegraphic communication between two vessels thus placed, and in this way each could communicate with the other, and take the means necessary to avoid the danger of collision. This would be a great step in advance, and considering that a modern steamer has little to fear from the ordinary perils of the sea, it would remove what is now about the only danger that threatens those who wish to make ocean voyages.

A Chapter in the Early History of the Telegraph.

To the Editor of Electrical Review:

It may not be known generally that one of the early supporters and backbone of the Western Union telegraph, president of the company at the time I write of, Hon. Hiram Sibley, lives in Rochester, N. Y., and is still in business, as head of the firm of Hiram Sibley & Co, seedsmen.

In the early summer of 1866 two of the then great enterprises in telegraphy were vieing with one another for supremacy. The Atlantic cable and the Russian Overland Telegraph or Westen Union extension were running a race for a European connection.

The Atlantic Cable Company, headed by Cyrus W. Field, had made four disastrous efforts to lay a cable. The loss of two cables added to these efforts were very discouraging. Atlantic Telegraph stock was sold for a song, and considered a good riddance. Russian Overland was 30 to 60 per cent. above par. The world believed in the Russian Overland, by which the extensive system controlled by the Western Union was to have a connection with Europe and London by an all-land line via Behring Straits.

Meantime, while all these preparations were being made for this gigantic enterprise, which was to girdle the earth with a wire, the Atlantic Cable Company were stowing away in the capacious hold of the now celebrated "Great Eastern" the immense coils of a third venture, destined to be more successful than the previous ones.

In the interest of his enterprise, Mr. Sibley and Mr. Collins went, in the winter of 1864, to London and St. Petersburgh to negotiate a right of way from the Russian-American Fur Company, who at that time controlled the Alaskan Territory, and to make arrangements for a mutual contract between the Russian Telegraph Department and the Western Union Company.

The contract was made; but the right of way was a more difficult matter. The Russian Fur Company was on the verge of bankruptcy, and it looked very much as though their rights would be transferred to the Hudson Bay Company. This, of course, was distasteful to Russia, as it would give the control of Alaska to England. Meantime the winter had passed, and the negotiations were not complete.

On the 26th of August, 1866, the first message was flashed across the Atlantic cable. The death-blow to the Russian Overland was given. The Western Union abandoned construction at once. In the wild enthusiasm over the operations of the Atlantic cable, the Russian Overland was forgotten; but many of the men sent out on its construction did not receive the news for a year afterwards. They had toiled on, believing the eyes of the world were upon them.

Buffalo, May 26. H.

Her Voice Returned.

In some instances it would be advisable, for the sake of peace and quietness, not to use electricity. Some days ago Miss Eulah Wilcox, of Paducah, Ky., while visiting with friends, complained of dizziness and asked for camphor. When this was brought it was found she could not utter a sound. For one week she was perfectly dumb, but otherwise in good health. Then a powerful shock from a galvanic battery was given to her, and soon afterward her voice returned as suddenly as it left her.

It Has Struck Buffalo.

A new primary battery has shown up in Buffalo, and the enthusiastic descriptions which appear in the local press, possess characteristics which betray an old acquaintance. It is said that "the inventor claims a new principle of obtaining electric force in direct conflict with the theories of scientists." The capital stock is $1,000,000, and some very excellent men are named as incorporators, but these gentlemen will probably insist on satisfactory proof of the merits of the invention, before investing—a very wise thing to do at all times.

TELEGRAPHIC

.... The Baltimore and Patuxent Telephone and Telegraph Company has been organized with Samuel Burns as president; J. Southgate Lemon, secretary, and John Turnbull, treasurer. The capital stock is $10,000.

.... According to a statement reported to have been made by Henry S. Ives, a consolidation of the Baltimore and Ohio Telegraph with the Postal and other independent lines is to be made, the consolidation taking the form of a new company, of which the Baltimore and Ohio will take one half the stock and so obtain control. He asserts that the Western Union cannot get the Baltimore and Ohio system at any price.

.... At a meeting last week of the Electrical Committee, Philadelphia, the National Fire Alarm Company, of New York, applied for permission to connect its proposed Philadelphia central office with the telegraph system of the Fire Bureau. A petition accompanying the proposed ordinance stated that the company was incorporated for the purpose of detecting the presence of fires in buildings by means of electricity. The matter was referred to a sub-committee, and to the chiefs of the Electrical and Fire Bureaus. An application from the Edison Electric Lighting Company to lay underground wires in certain streets was also referred to that sub-committee.

... In the case of the Western Union Telegraph Company against William Pendleton, before the United States Supreme Court, the judgment of the Indiana Supreme Court was reversed, and the cause remanded for further proceedings. This was a suit brought by the sender of a telegram from Shelbyville, Ind., to Ottumwa, Iowa, to recover a penalty of $100 under a statute of Indiana prescribing the manner in which telegrams shall be sent and delivered. The complainant alleged that his telegram had been put in the post office at the point of destination, instead of being delivered, and that this was in violation of the Indiana statute. The telegraph company maintained that the State could not constitutionally regulate the method of delivery of a telegram in another State, because such action would be a regulation of inter-state commerce. This court holds that the attempted regulation by Indiana of the mode in which messages sent by telegraph companies doing business within her limits shall be delivered in other States cannot be upheld.

.... In the State of Georgia the Western Union raises a nice point in the tax returns which it makes. The statutes bearing upon this subject require telegraph companies to pay a tax of one and one-half per cent. upon the gross receipts of the business done in Georgia. The company in question files two sets of returns. The first embraces what might be termed the purely Georgia business—business taken at Georgia points for other points in the State. The second return shows the total amount of business taken at Georgia offices without reference to the destination of the messages. The company contends that the first of these two returns is the proper one for it to make, while the State authorities insist that the law plainly means that taxes shall be paid upon the gross receipts of offices in the State, without any reference to the destination of the business. In support of its claim, the company urges that the State has no right to tax receipts earned beyond the limits of the State, even though it may originate in, and a large proportion of it be earned within the borders of the State. While in Augusta, recently, the comptroller-general had a talk with Hon. John S. Davidson, attorney for the Western Union, who asked that he be given a hearing before the comptroller general makes his decision upon this point. It is probable that he will be given an early opportunity to present his views to the comptroller-general and attorney-general.

Novel Phenomena of Alternating Currents.

READ BY ELIHU THOMSON BEFORE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The actions produced and producible by the agency of alternating currents of considerable energy, are assuming greater importance in the electric arts. I mean, of course, by the term alternating currents, currents of electricity reversed at frequent intervals, so that a positive flow is succeeded by a negative flow, and that again by a positive flow, such reversals occurring many times in a second, so that the curve of current or of electromotive force will, if plotted, be a wave line, the amplitude of which is the arithmetical sum of the positive and negative maxima of current or electromotive, as the case may be, while a horizontal middle line joins the zero points of current or electromotive force.

It is well known that such a current passing in a coil or conductor laid parallel with or in inductive relation to a second coil or conductor, will induce in the second conductor, if on open circuit, alternating electromotive forces, and that if its terminals be closed or joined, alternating currents of the same rhythm, period or pitch, will circulate in the second conductor. This is the action occurring in any induction coil whose primary wire is traversed by alternating currents, and whose secondary wire is closed either upon itself directly or through a resistance. What I desire to draw attention to in the present paper are the mechanical actions of attraction and repulsion which will be exhibited between the two conductors, and the novel results which may be obtained by modifications in the relative dispositions of the two conductors.

In 1884, while preparing for the International Electrical Exhibition at Philadelphia, we had occasion to construct a large electro-magnet, the cores of which were about six inches in diameter and about twenty inches long. They were made of bundles of iron rod of about $\frac{5}{16}$ inch diameter. When complete the magnet was energized by the current of a dynamo giving continuous currents, and it exhibited the usual powerful magnetic effects. It was found also that a disk of sheet copper, of about $\frac{1}{16}$ inch thickness and 10 inches in diameter, if dropped flat against a pole of the magnet, would settle down softly upon it, being retarded by the development of currents in the disk due to its movement in a strong magnetic field, and which currents were of opposite direction to those in the coils of the magnet. In fact, it was impossible to strike the magnet pole a sharp blow with the disk, even when the attempt was made by holding one edge of the disk in the hand and bringing it down forcibly towards the magnet. In attempting to raise the disk quickly off the pole, a similar but opposite action of resistance to movement took place, showing the development of currents in the same direction to those in the coils of the magnet, and which currents, of course, would cause attraction as a result.

The experiment was, however, varied, as in Fig. 1. The disk D was held over the

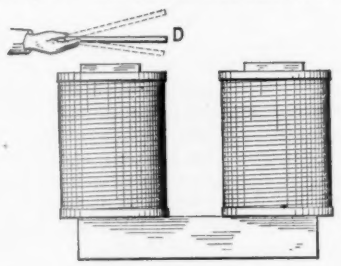

FIG. 1.

magnet pole, as shown, and the current in the magnet coils cut off by shunting them. There was felt an attraction of the disk or a dip toward the pole. The current was then put on by opening the shunting switch and a repulsive action or lift of the disk was felt. The actions just described are what would be expected in such a case, for when attraction took place, currents had been induced in the disk D in the same direction as those in the magnet coils beneath it, and when repulsion took place the induced current in the disk was of opposite character or direction to that in the coils.

Now let us imagine the current in the magnet coils to be not only cut off, but reversed back and forth. For the reasons just given we will find that the disk D is attracted and repelled alternately, for, whenever the currents induced in it are of the same direction with those in the inducing, or magnet coil, attraction will ensue, and when they are opposite in direction, repulsion will be produced. Moreover, the repulsion will be produced when the current in the magnet coil is rising to a maximum in either direction, and attraction will be the result when

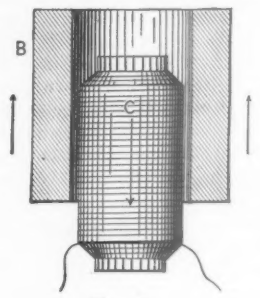

FIG. 2.

the current of either direction is falling to zero, since in the former case opposite currents are induced in the disk D in accordance with well-known laws; and in the latter case currents of the same direction will exist in the disk D and the magnet coil. The disk might, of course, be replaced by a ring of copper or other good conductor, or by a closed coil of bare or insulated wire, or by a series of disks, rings or coils super-

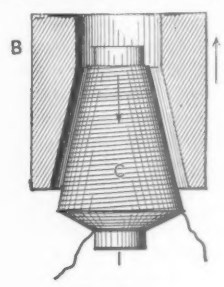

FIG. 3.

posed, and the results would be the same. Thus far, indeed, we have nothing of a particularly novel character, and, doubtless, other experimenters have made very similar experiments and noted similar results to those described.

The account just given of the effects produced by alternating currents, while true, is not the whole truth, and just here we may supplement it by the following theorems:

An alternating current circuit or coil repels and attracts a closed circuit or coil placed in direct or magnetic inductive relation there-

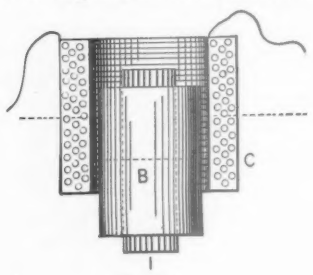

FIG. 4.

with, but the repulsive effect is in excess of the attractive effect.

When the closed circuit or coil is so placed, and is of such low resistance metal that a comparatively large current can circulate as an induced current, so as to be subject to a large self-induction, the repulsive far exceeds the attractive effort.

For want of a better name I shall call this excess of repulsive effect the "electro-inductive repulsion" of the coils or circuits.

This preponderating repulsive effect may be utilized or may show its presence by producing movement or pressure in a given direction, by producing angular deflection as of a pivoted body, or by producing continuous rotation with a properly organized structure. Some of the simple devices realizing the conditions I will now describe.

In FIG. 2 C is a coil traversed by alternating currents, B is a copper case or tube surrounding it, but not exactly over its center. The copper tube B is fairly massive and is the seat of heavy induced currents. There is a preponderance of repulsive action

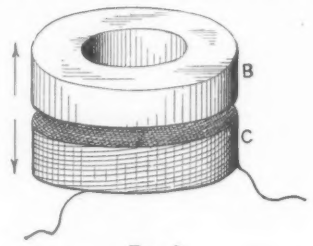

FIG. 5.

tending to force the two conductors apart in an axial line. The part B may be replaced by concentric tubes slid one in the other, or by a pile of flat rings, or by a closed coil of coarse or fine wire insulated, or not. If the coil C, or primary coil, is provided with an iron core such as a bundle of fine iron wires, the effects are greatly increased in intensity and the repulsion with a strong primary cur-

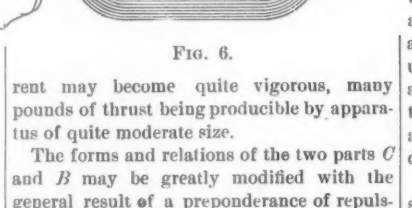

FIG. 6.

rent may become quite vigorous, many pounds of thrust being producible by apparatus of quite moderate size.

The forms and relations of the two parts C and B may be greatly modified with the general result of a preponderance of repulsive action when the alternating currents circulate.

Fig. 3 shows the part B of an internally tapered or coned form, and C of an externally coned form, wound on an iron wire bundle I. The action in Fig. 2 may be said to be analogous to that of a plain solenoid with its core, except that repulsion, and not attraction, is produced, while that of Fig. 3 is more like the action of tapered or conically wound solenoids and taper cores. Of course it is unnecessary that both be tapered. The effect of such shaping is simply to modify the range of action and the amount of repulsive effort existing at different parts of the range.

In Fig. 4 the arrangement is modified so that the coil C is outside, and the closed band or circuit B inside and around the core I. Electro-inductive repulsion is produced as before.

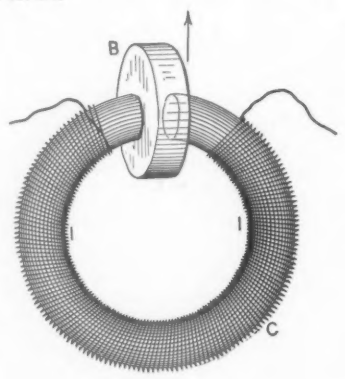

FIG. 7.

It will be evident that the repulsive actions will not be mechanically manifested by axial movement or effort, when the electrical middles of the coils or circuits are coincident. In cylindrical coils in which the current is uniformly distributed through all the parts of the conductor section, what I here term the electrical middle, or the center of gravity of the ampere turns of the coils, will be the plane at right angles to its axis at its middle, that of B and C in Fig. 4 being indicated by a dotted line. To repeat, then, when the centers or center planes of the conductors, Fig. 4, coincide, no indication of electro-inductive repulsion is given, because it is mutually balanced in all directions; but when the coils are displaced, a repulsion is manifested, which reaches a maximum at a position depending on the peculiarities of proportion and distribution of

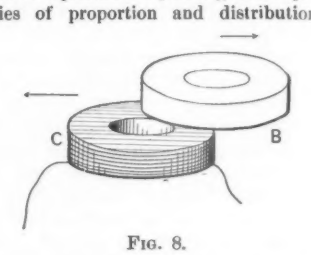

FIG. 8.

current at any time in the two circuits or conductors.

It is not my purpose now to discuss the ways of determining the distribution of currents and mechanical effects, as that would extend the present paper much beyond its intended limit. The forms and relative arrangement of the two conductors may be greatly varied. In Fig. 5 the parts are of equal diameter, one, B, being a closed ring, and the other, C, being an annular coil, placed parallel thereto; and an iron core or wire bundle, placed in the common axis of the two coils, increases the repulsive action. B may be simply a disk or plate of any form, without greatly affecting the nature of the action produced. It may also be composed of a pile of copper washers, or a coil of wire, as before indicated.

An arrangement of parts somewhat analogous to that of a horseshoe electro-magnet and armature is shown in Fig. 6. The alternating current coils C C' are wound upon an iron wire bundle bent into U-form, and opposite its poles is placed a pair of thick copper disks, B B', which are attracted and repelled, but with an excess of repulsion depending on their form, thickness, etc.

If the iron core takes the form of that shown by I I, Fig 7, such as a cut ring with the coil C wound thereon, the insertion of a heavy copper plate, B, into the slot or divided portion of the ring, will be opposed by a repulsive effort, when alternating currents pass in C. This was the first form of

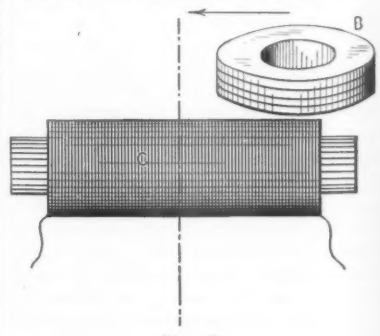

FIG. 9.

device in which I noticed the phenomenon of repulsive preponderance in question. The tendency is to thrust the plate B out of the slot in the ring, excepting only when its center is coincident with the magnetic axis joining the poles of the ring between which B is placed.

If the axes of the conductors, Fig. 5, are not coincident, but displaced, as in Fig. 8, then, besides a simple repulsion apart, there

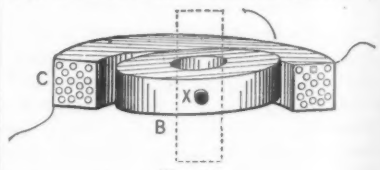

FIG. 10.

is a lateral component or tendency, as indicated by the arrows. Akin to this is the experiment illustrated in Fig. 9. Here the closed conductor B is placed with its plane at right angles to that of C, wound on a wire bundle. The part B tends to move toward the center of the coil C, so that its axis will be in the middle plane of C, transverse to

the core, as indicated by the dotted line. This leads us at once to another class of actions, *i. e.*, deflective actions.

When one of the conductors, as *B*, Fig. 10, composed of a disk, or better, of a pile of thin copper disks, or of a closed coil of wire, is mounted on an axis *X* transverse to

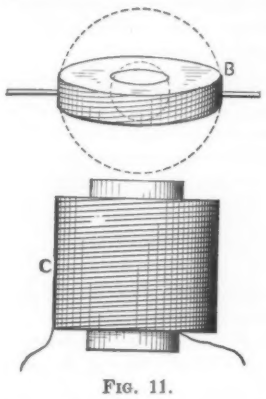

FIG. 11.

the axis of coil *C*, through which coil the alternating current passes, a deflection of *B* to the position indicated by dotted lines will take place, unless the plane of *B* is at the start exactly coincident with that of *C*. If slightly inclined at the start, deflection will be caused as stated. It matters not whether

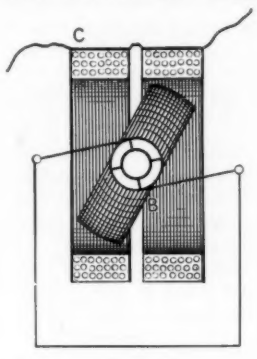

FIG. 14.

equal attractions and repulsions, because currents would be induced in opposite directions to that of the primary current when the latter current was changing from zero to maximum, positive or negative current, so producing repulsion; and would be induced in the same direction when changing from maximum positive or negative value to zero, so producing attraction.

This condition can be illustrated by a diagram, Fig. 12. Here the lines of zero current are the horizontal straight lines. The wavy lines represent the variations of current strength in each conductor, the current in one direction being indicated by that

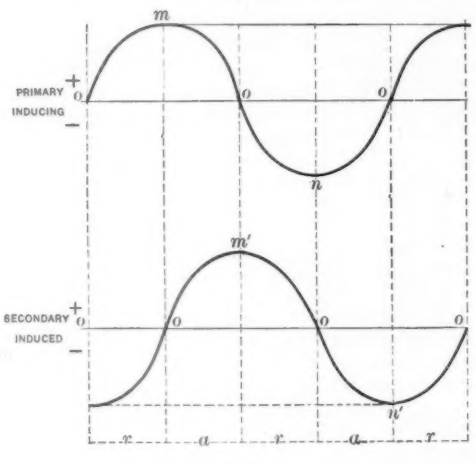

FIG. 12.

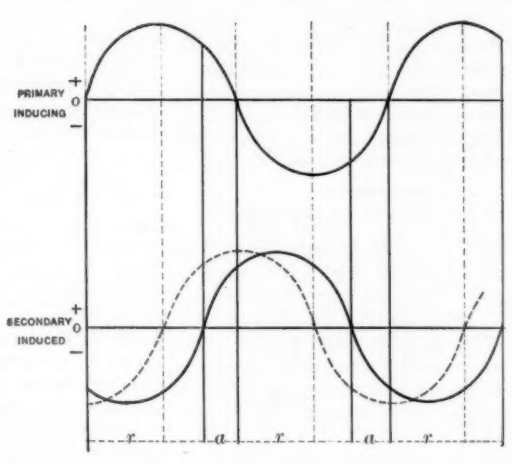

FIG. 13.

will occur. These actions of attraction and repulsion will be reproduced continually, there being a repulsion, then an attraction, then a repulsion, and again an attraction, during one complete wave of the primary current. The letters *r*, *a*, at the foot of the diagram, Fig. 12, indicate this succession.

In reality, however, the effects of self induction in causing a lag shift, or retardation of phase in the secondary current, will considerably modify the results, and especially so when the secondary conductor is constructed so as to give to such self-induction a large value. In other words, the maxima of the primary or inducing current will no longer be found coincident with the zero points of the secondary currents. The effect will be the same as if the line representing the wave of the secondary current in Fig. 12 had been shifted forward to a greater or less extent. This is indicated in diagram, Fig. 13. It gives doubtless an exaggerated view of the action, though from the effects of repulsion which I have produced I shall say it is by no means an unrealizable condition.

It will be noticed that the period during which the currents are opposite, and during which repulsion can take place, is lengthened at the expense of the period during which the currents are in the same direction for attractive action. These differing periods

he coil *C* incloses the part *B* or be inclosed by it, or whether the coil *C* be pivoted and *B* fixed, or both be pivoted. In Fig. 11 the coil *C* surrounds an iron wire core *I*, and *B* is pivoted above it, as shown. It is deflected, as before, to the position indicated in dotted lines.

It is important to remark here that, in cases where deflection is to be obtained, as in Figs. 10 and 11, *B* had best be made of a pile of thin washers or a closed coil of insulated

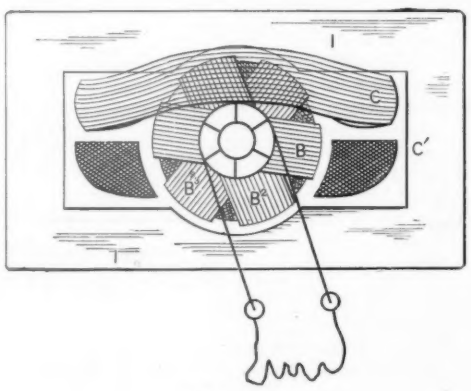

FIG. 15.

wire instead of a solid ring. This avoids the lessening of effect which would come from the induction of currents in the ring *B* in other directions than parallel to its circumference.

We will now turn our attention to the explanation of the actions exhibited, and afterwards refer to their possible applications. It may be stated as certainly true that were the induced currents in the closed conductor unaffected by any self induction, the only phenomena exhibited would be alternate

portion of the curve above the zero line, and in the other direction by that portion below it. The vertical dotted lines simply mark off corresponding portions of phase or succession of times.

Here it will be seen that in the positive primary current descending from *m*, its maximum to the zero line, the secondary current has risen from its zero to m^1, its maximum. Attraction will therefore ensue, for the currents are in the same direction in the

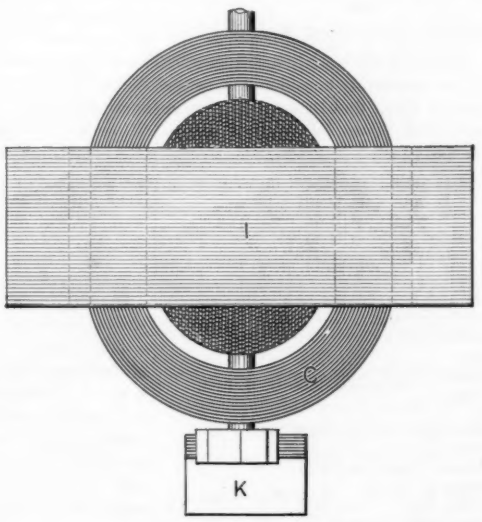

FIG. 16.

two conductors. When the primary current increases from zero to its negative maximum *n*, the positive current in the secondary closed circuit will be decreasing from m^1, its positive maximum, to zero; but as the currents are in opposite directions, repulsion

are marked *r*, *a*, etc., or the period during which repulsion exists is from the zero of the primary or inducing current to the succeeding zero of the secondary or induced current; and the period during which attraction exists is from the zero of the induced current to the zero of inducing current.

But far more important still, in giving prominence to the repulsive effect than this difference of effective period, is the fact that during the period of repulsion both the inducing and induced currents have their greatest values, while during the period of attraction the currents are of small amounts comparatively. This condition may be otherwise expressed by saying that the

(*Continued on page* 10.)

ELECTRIC LIGHT NEWS

—— The Welsbach Incandescent Light Company has filed a certificate of incorporation at Albany. Capital, $4,500,000.

—— The Progress Electric Light and Motor Company have purchased the property of the Mobile (Ala.) Electric Light Company.

—— The Westinghouse incandescent system has been adopted by the Brush Electric Light Company of New Orleans, and a 5,000 light plant will be installed.

—— At Galveston, Texas, the Brush Electric Light and Power Company have contracted for an additional incandescent light plant of 2,000 lights capacity.

——Findlay, Ohio, has granted a franchise for an electric street railway, to Mr. S T. Dunham, of New York, who is constructing similar lines at Mansfield and Steubenville, in the same State.

—— The New York Electrical Society, of which Mr. J. M. Pendleton is president, and Mr. Joseph Wetzler is secretary, is arranging to give an exhibition at the American Institute fair to be held this fall.

—— The Houston, Texas, Electric Light and Power Company has organized with a capital stock of $50,000, has been incorporated with D. F. Stuart, W. R. Baker, F. A. Rice, S. K. McIlhenny and E. Raphael as directors.

—— The Pacific Coast offices of the American Electric Manufacturing Company have been opened at 330 Pine street, San Francisco. Mr. F. W. Pope-Cox will be in charge as general agent of the company, and anticipates a large lighting business.

—— The New York Gas Commission has awarded to the Brush Electric Light Company the contract for lighting all its present city territory, except Union and Madison Squares. The rate is 25 cents per arc lamp per night, and 324 lamps are included in the contract. New bids will be advertised for lighting the rest of the city.

—— Sohneke states that the electricity which is discharged during a thunder storm is produced by the friction of water and ice, that is, that the ice is electrified by friction with water. Just before a thunder storm water clouds (cumuli) and ice clouds (cirri, cirros, rati) appear simultaneously in the sky. The friction of these particles of ice and water is a sufficient cause of the electricity which is generated.

—— Messrs. Getz & Odendall have recently obtained orders for some batteries of their largest-sized accumulators of the Farbaky-Schneck type. The firm of Kremenetzky & Mayer (the Brush Company) also talk of manufacturing accumulators of the E P.S. type in Vienna. It will be interesting to see what may be done by either of the above firms as regards the question of patents if the latter proposal of the Brush Company is carried out.

—— Says the London *Electrician:* Some time ago M. Nothomb succeeded in launching a company for supplying the city of Antwerp with electric light. This new undertaking was, however, immediately attacked by the gas company, who claimed to possess the exclusive right to light the town until the year of grace 1912. The action has been carried from court to court, but the final Court of Appeal at Brussels has now decided in favor of the claims of the gas company. The commiseration of the whole civilized world—even of London itself—may well be extended to this unfortunate city, doomed without hope of release, except from the good will of the company, to see by gas flames for another quarter of a century.

(*Continued from page* 9.)

period during which repulsion occurs includes all the maxima of current, while the period of attraction includes no maxima. There is then a repulsion due to the summative effects of strong opposite currents for a lengthened period, against an attraction due to the summative effects of weak currents of the same direction during a shortened period, the resultant effect being a greatly preponderating repulsion.

It is now not difficult to understand all the actions before described as obtained with the varied relations of coils, magnetic fields and closed circuits. It will be easily understood, also, that an alternative magnetic field is in all respects the same as an alternating current coil in producing repulsion on the closed conductor, because the repulsions between the two conductors are the result of magnetic repulsions arising from opposing fields produced by the coils when the currents are of opposite directions in them.

Thus far I have applied the repulsive action described in the construction of alternating current indicators, alternating current arc lamps, regulating devices for alternating currents, and to rotary motors for such currents. For current indicators a pivoted or suspended copper band or ring, composed of thin washers piled together and insulated from one another and made to carry a pointer or index, has been placed in the axis of a coil conveying alternating currents whose amount or potential is to be indicated. Gravity or a spring is used to bring the index to the zero of a divided scale, at which time the plane of the copper ring or band makes an angle of, say, 15 degrees to 20 degrees with the plane of the coil. This angle is increased by deflection more or less great, according to the current traversing the coil. The instrument can be calibrated for set conditions of use. Time would not permit of a full description of these arrangements as made up to the present.

In arc lamps the magnet for forming the arc can be composed of a closed conductor, a coil for the passage of current, and an iron wire core. The repulsive action upon the closed conductor lifts and regulates the carbons in much the same manner that electromagnets do when continuous currents are used. The electro-inductive repulsive action has also been applied to regulating devices for alternating currents, with the details of which I cannot now deal.

For the construction of an alternating current motor which can be started from a state of rest the principle has also been applied, and it may here be remarked that a number of designs of such motors is practicable.

One of the simplest is as follows: The coils *C*, Fig. 14, are traversed by an alternating current and are placed over a coil *B*, mounted upon a horizontal axis, transverse to the axis of the coil *C*. The terminals of the coil *B*, which is wound with insulated wire, are carried to a commutator, the brushes being connected by a wire as indicated. The commutator is so constructed as to keep the coil *B* on short circuit from the position of coincidence with the plane of *C*, to the position where the plane of *B* is at right angles to that of *C*; and to keep the coil *B* open circuited from the right angled position or thereabouts to the position of parallel or coincident planes. The deflective repulsion exhibited by *B* will, when its circuit is completed by the commutator and brushes, as described, act to place its plane at right angles to that of *C*, but being then open-circuited its momentum carries it to the position just past parallelism, at which moment it is again short-circuited, and so on. It is capable of very rapid rotation, but its energy is small. I have, however, extended the principle to the construction of more complete apparatus. One form has its revolving portion or armature composed of a number of sheet iron disks wound as usual with three coils crossing near the shaft. The commutator is arranged to short-circuit each of these coils in succession, and twice in a revolution, and for a period of 90 degrees of rotation each. The field coils surround the armature and there is a laminated iron field structure completing the magnetic circuit. I may say here that surrounding the armature of a dynamo by the field coils, though very recently put forth as a new departure, was described in various Thomson-Houston patents, and to a certain extent all Thomson-Houston machines embody this feature.

Figs, 15 and 16 will give an idea of the construction of the motor referred to. *C C*^{1} are the field coils or inducing coils, which alone are put into the alternating current circuit. *I I* is a mass of laminated iron, in the interior of which the armature revolves, with its three coils *B*, *B*^{2}, *B*^{3} wound on a core of sheet iron disks. The commutator short-circuits the armature coils in succession in the proper positions to utilize the repulsive effect set up by the currents which are induced in them by the alternations in the field coils. The motor has no dead point and will start from a state of rest and give out considerable power, but with what economy is not yet known.

A curious property of the machine is that at a certain speed, depending on the rapidity of the alternations in the coil *C*, a continuous current passes from one commutator brush to the other, and it will energize electromagnets and perform other actions of direct currents. Here we have, then, a means of inducing direct currents from alternating currents. To control the speed and keep it at that required for the purpose, we have only to properly gear the motor to another of the ordinary type for alternating currents, namely, an alternating current dynamo used as a motor. The charging of storage batteries would not be difficult with such a machine, even from an alternating current line, though the losses might be considerable.

Electric Light at Girard College.

Girard College and grounds were lighted for the first time last week by the artificial light produced by the Fort Wayne Jenney Electric Light Company. Seven huge towers, each one hundred and twenty-five feet high, had been arranged at suitable places throughout the grounds, each tower containing five electric lights with an aggregate lighting power of 10,000 candles. The total lighting capacity amounts to fifty lights, but the first evening only thirty-five were in use. The effect of this scheme of lighting is similar to moonlight, and it was so well diffused that it was possible to read a newspaper in nearly every part of the large enclosure. Among those who witnessed the successful exhibition of this system were Director Wagner and Messrs. Comegys and Michener, members of the Board of City Trusts; Architect Windrim, who disposed the lights; President Fetterolf, of the college; David Walker, of the electrical department of the city, and G. A. Wilbur, agent of the company.

Comparison of Lineal Measures.

Note.—United States and British measures of length are commonly considered to be the same; but in fact, the British are shorter than the United States by about 1 part in 17.230, or 3.677 inches in a mile.

U. S. inch	= .025401	meter.
U. S. foot	= .30481	"
U. S. yard	= .914430	"
British inch	= .0253995	"
British foot	= .304794	"
British yard	= .914382	"
U. S. and British yard	= 36	inches.
French meter	= 39$\frac{3}{8}$	"
Spanish vara	= 32$\frac{7}{8}$	"
France, Belgium, Holland, Italy	meter = 3.2809	U. S. feet.
Swedish foot	= 0.974	" "
Prussia, Denmark, Norway	foot = 1.029	" "
Austrian foot	= 1.037	" "
Spanish vara	= 2.738	" "
Portuguese, Brazilian	vara = 3.934	" "
Egyptian pik	= 2.515	" "

The best silk for suspension of galvanometer needles is obtained from the middle of the cocoon. The cocoon should be steeped in tepid water and the silk wound off it on to a simple reeling machine.

OUR CHICAGO LETTER.

(From a Special Correspondent of the ELECTRICAL REVIEW.)

Mr. John Young, of the Western Electric Company, has recently concluded a contract with the Laclede Hotel Company at St. Louis, to furnish the hotel with the W. E. system of return call and fire alarm apparatus. This will be placed to connect one hundred and fifty rooms with the office.

It is claimed for this system that the battery is tested several times daily, and that, therefore, there can be but the faintest possibility of this being out of order when an emergency arises. The Buffalo fire is working a revival in favor of automatic alarms of this nature, which is certainly a move in the right direction.

The W. E. Company is arranging for an extension of their present works, so soon as the occupants of the structure south of the present building can vacate. In the course of a few weeks at the most, the company will commence the work, and as soon as possible complete the structure, which will be 150 × 60, and four stories in height, exclusive of the basement.

The electrical people of the city of Chicago have for a long time been itching with a desire to have an electrical club, and the contagion has spread until the matter took a tangible form one evening last week, and an organization was effected as follows: President, A. K. Stiles; vice-presidents, C. A. Brown, Jno. P. Barrett, B. E. Sunny, F. G. Beach; secretary, W. A. Kreidler; treasurer, F. A. Terry; board of managers, W. A. Stiles, B. E. Sunny, W. A. Kreidler, C. D. Shain, J. P. Barrett, C. A. Brown, W. J. Armstrong, F. S. Terry, Wm. J. Lloyd, and W. J. Buckley.

The combination represents nearly every variety of electrical enterprise, from the merchant to the manufacturer of electrical appliances, and from dealers in the minutest to users of the most powerful currents.

Considerable discussion was indulged in relative to the fees and dues of initiates and members; but the following were finally adopted. Initiation, $10. Yearly dues for resident members, $12, and for non-resident members, $8.

It is the intention of the club to procure rooms at as early a date as possible, where all the social advantages of a club may be enjoyed by the members. Regular meetings will be held, and contributions of papers on electricity solicited from the membership.

Everything so far shows a lively and praiseworthy enthusiasm, and already it has been suggested that one of the first duties the members owe to their own interests is the commencement of an electrical library. While we can hardly expect to eclipse our lively brethren at the East, we hope and trust we shall be able to show a reciprocal hospitality, if ever we do catch one of them here. We believe the Chicago Electrical Club has come to stay.

One of the funniest phases of the telephone regulation craze here, appeared in a daily paper wherein the writer says the proposition before the Council seems to be a covert attempt to create "sympathy for the aforesaid company, if we remember that this ordinance is offered just as the people are about to secure some protective legislation at Springfield. It would seem to the writer that if the people wish to be successful in their fight against the extortionate charges of the telephone companies they should immediately bend all their energies toward securing State legislation, and demand of their local representatives that they cease at once entertaining measures in the Council which bear the mark of being the handiwork of the telephone company. It is proposed at Springfield to enact some laws to materially lower the present outrageous telephone charges. Can such legislation be successfully carried out when it is known that the poor telephone company here is to be 'taxed to death' by the city? The contemplated ordinance looks to an outsider to be a measure cunningly devised by the telephone company to create sympathy among the Solons at Springfield and thus kill the law regulating charges."

There are echoes to the lion's roar, and according to an old fable, these are sometimes but the dulcet songs of lop-eared donkeys. Every Sunday afternoon in Chicago the Socialists, in convention assembled, ventilate their spleen on anybody and anything which they think will be most likely to attract public attention. One of these wise gentlemen the other Sunday broke the Sabbath stillness with a long preamble and resolution attacking the telephone monopoly, and demanding that the State appropriate the plant and run the business. A long discussion ensued, after which the resolution passed, and a copy was ordered sent to the Council!

A curious disturbance of electric wires was discovered the other night, by the flashing of the dynamo. The two wires in lead-covered cable were carried through a hole in the wall beneath the sidewalk, and thence to a lateral of the underground conduit.

There was not quite room enough for an abnormally large rat to get through, and as the lead was softer than the surrounding wall, he proceeded to enlarge the hole by gnawing the lead. He did it, and the current wreaked terrible revenge on the rat, which was so effectually cooked that a long-tailed almond-eyed son of Confucius came running toward the spot, with the remark in Yellow sea vernacular: "Hi yah! my smelle flied lat, loastee too muchee," a statement, coming as it does from an outsider, which is perhaps to be taken with some grains of allowance.

In some recent tests of various forms of railroad brakes the new triple-valve Westinghouse air brakes have been operated by electricity. The saving through this combination, by which the power is applied at the wheels of thirteen freight cars simultaneously, effected only a saving of twenty feet, at a speed of forty miles per hour. Experiments are being continued, but it appears problematical whether the saving will be commensurate with the additional expense and complications. The new triple-valve brake shows a gain over the former system of valves of about 30 per cent.

The Charleston, Ill., Electric Light Company, with $10,000 capital stock, was recently incorporated by J. W. Neal, W. E. Hill, F. K. Dunn, A. M. Mitchell and W. P. McCrory.

The Joliet Gas and Fuel Company, at Joliet, Ill, with a capital stock of $150,000, purpose the manufacture of gas, electric power and fuel. The incorporators are O. F. Aldis, Edw. Hilton and S. H. Wright.

The American University of Electro-Magnetic Therapeutics, with a capital stock of $10,000, is designed to promote a more extensive knowledge of electrical medications and is a Chicago institution. The incorporators are Robert Greer, Mary Greer and J. H. McDonald.

CHICAGO, May 30, 1887.

The Manholes Exploded.

In Philadelphia last Monday, explosive gas, confined in the underground conduit for electric light, blew up all the manholes between Seventh to Ninth on Chestnut street.

The Belgian blocks along the street faintly marked the course of the conduit beneath them by showing here and there a loosened block. The covers of the two manholes at Seventh and Chestnut street were lifted twenty feet in the air, just as a Chestnut street car, which had stopped at the corner, moved on. It moved on more quickly than usual.

The underground system scored a point against the overhead system, by breaking one or two overhead wires. A boy stood at Ninth street, near one of the manholes, when the explosion came. He had vanished one and a quarter seconds later. An express wagon had just passed over one of these dangerous spots. The driver whipped up his horses and wished he was the Czar.

If the explosion had happened an hour or two earlier, when Grand Army posts were passing every few minutes, the consequences might have been much more serious.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MAY 24, 1887.

363,440 Secondary electric clock movement; Chas. D. Warner, Ansonia, Ct.

363,449 Telephony; John J. Carty, Cambridge, assignor to the American Bell Telephone Company, Boston, Mass

363,463 Method of and apparatus for operating pressure or vacuum brakes; 363,464, Electro-pneumatic brake for railroad trains; Herman Hollerith, New York, N. Y.

363,466 Electric motor and dynamo-electric machine; Rudolph M. Hunter, Philadelphia, Pa.

363,498 Primary electric pendulum clock; Joseph Zeiner, Munich, Germany.

363,500 Incandescent electric lamp; C. Gustaf Anderson, Hartford, Ct.

363,550 Manufacture of watch main-springs; Frederick Sedgwick, Chicago, Ill.

363,559 Incandescent electric lamp; William Stanley, jr., Great Barrington, Mass., assignor to George Westinghouse, Jr., Pittsburgh, Pa.

363,562 Electrolyte; Anson C. Tichenor, San Francisco, Cal.

363,567 Lightning arrester; and 363,568, Incandescent lamp fixture; Merle J. Wightman and Hermann Lemp, Hartford, Ct.

363,574 Mail-box indicator; Clinton M. Ball, Boston, Mass., and Thomas J. McTighe, New York, N. Y.

363,611 Electric arc lamp; Julian F. Denison, New Haven, Ct.

363,623 Electric lock; Malon I. Flowers, Springfield, assignor of one-half to James E. Jones, Greene County, Mo.

363,644 and 363,645 Electric temperature-controlling device; Henry E. Jacobs, Fond du Lac, Wis.

363,669 System of conversion of electrical energy into mechanical force; Henry M. Paine, Newark, N. J.

363,702 Shade or globe holder; Samuel B. H. Vance, New York, N. Y.

BUSINESS NOTICE.

"In making the statements which follow we can verify each and all of them as facts. Mr. Edward P. Thompson, of Temple Court [7 Beekman St.,] New York, is a good man to bring your patent cases to, for he is thoroughly versed in all the ins and outs of a Patent Attorney's duties. The following are some of his qualifications: Graduate of Stevens Institute as Mechanical Engineer. For four years tutor of classes of young men in mathematics and experimental physics at Elizabeth, N. J. Served professionally as Electrician and Chemist in the Swan Electric Company of New York for two years. Because of past successes as a Patent Attorney at 13 Park Row, New York, was appointed, to succeed N. S. Keith, of the patent agency of the *Electrical World* and Associate Editor. N. S. Keith is known as the Translator and Reviser of Schellen's Treatise on "Dynamo Electric Machinery." Mr. Thompson for two years personally prepared and prosecuted all the patent business of *Electrical World's* Patent Agency, and is the author of a series of articles in said paper upon "Analytical and Systematic Method of Inventing," which were widely known and favorably received. Mr. Thompson is a member of American Institute of Electrical Engineers and American Society of Mechanical Engineers. He is author of the "Expansion of Polynomials," which the ablest mathematicians of the world universally commend." —*New York Observer*.

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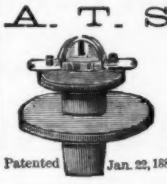

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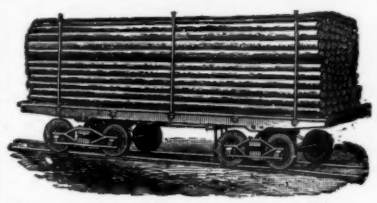

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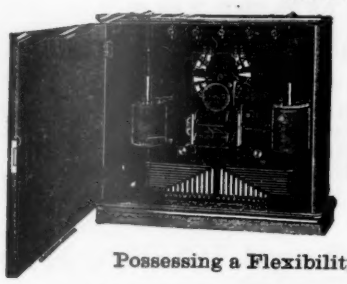

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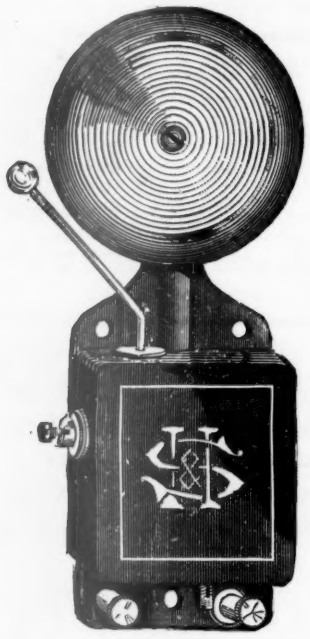

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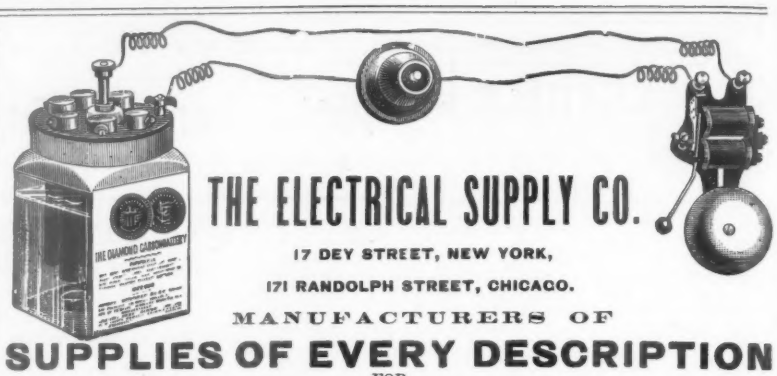

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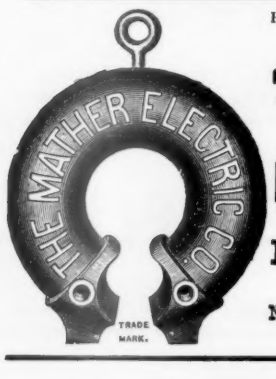

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